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(54) ORGANIC ELECTROLUMINESCENCE ELEMENT HAVING LAYER CONTAINING CONDUCTIVE HIGHPOLYMER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic electroluminescence element to make light emission at a high light emission efficiency and capable of being driven at a low voltage, in particular even in the blue region, emitting the light at a high light emission efficiency, and having a high durability even when light emission is made with a high brightness.

SOLUTION: The organic electroluminescence element includes a light emitting layer formed between an anode and cathode through an evaporation process, wherein the light emitting layer has an adjoining layer containing at least one sort of light emitting material which makes light emission in the triplet excited condition and located adjacent to at least either of the anode side and cathode side of the light emitting layer, and the adjoining layer contains a conductive highpolymer.

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CLAIMS

[Claim(s)]

[Claim 1] They are the organic electroluminescence devices which have the luminous layer formed of vacuum evaporation between an anode plate and cathode, a luminous layer contains at least one sort of luminescent material which emits light from a triplet excitation state, have the adjacent layer which adjoins at least one side by the side of the anode plate of a luminous layer, and cathode, and are characterized by an adjacent layer containing a conductive polymer.

[Claim 2] Organic electroluminescence devices according to claim 1 to which the minimum excitation triplet energy level of luminescent material is characterized by 63 or more kcal/mol being 81 or less kcal/mol.

[Claim 3] Organic electroluminescence devices according to claim 1 or 2 characterized by the quantum yield of the phosphorescence of luminescent material being 0.5 or more.

[Claim 4] Organic electroluminescence devices according to claim 1 to 3 characterized by the minimum excitation triplet energy level of the luminous layer except luminescent material being 64kcal/mol or more 82kcal/mol or less.

[Claim 5] Organic electroluminescence devices according to claim 1 to 4 characterized by the electrical conductivity of an adjacent layer being one or more 10^{-6} S-cm.

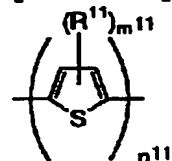
[Claim 6] Organic electroluminescence devices according to claim 1 to 5 characterized by a conductive polymer being the disconjugation macromolecule or conjugation macromolecule which connected the terrorism ring with an aromatic series ring or aromatic series by the connection radical more than bivalence.

[Claim 7] Organic electroluminescence devices according to claim 1 to 6 characterized by being the conjugation macromolecule with which the conductive polymer had the dopant doped.

[Claim 8] Organic electroluminescence devices according to claim 1 to 7 characterized by a conductive polymer having the substructure expressed with the following general formula (I).

General formula (I)

[Formula 1]

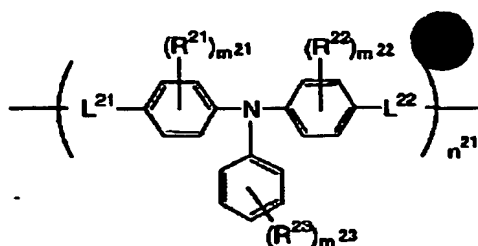


R^{11} expresses a substituent among a formula and m_{11} expresses the integer of 0 thru/or 2. When m_{11} expresses 2, two or more R^{11} may be mutually the same, or may differ, may be connected mutually, and may form a ring. n_{11} expresses one or more integers.

[Claim 9] Organic electroluminescence devices according to claim 1 to 6 characterized by a conductive polymer having the substructure expressed with the following general formula (II).

General formula (II)

[Formula 2]

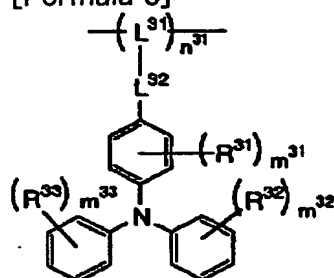


L21 and L22 express a divalent connection radical among a formula. R21, R22, and R23 express a substituent, m21 and m22 express the integer of 0 thru/or 4, and m23 expresses the integer of 0 thru/or 5. When m21 and m22 express the integer of 2 thru/or 4 and m23 expresses the integer of 2 thru/or 5, two or more R21, R22, and R23 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n21 expresses one or more integers.

[Claim 10] Organic electroluminescence devices according to claim 1 to 6 characterized by a conductive polymer having the substructure expressed with the following general formula (III).

General formula (III)

[Formula 3]



A connection radical trivalent in L31 and L32 express single bond or a divalent connection radical among a formula. R31, R32, and R33 express a substituent, m31 expresses the integer of 0 thru/or 4, and m32 and m33 express the integer of 0 thru/or 5. When m31 expresses the integer of 2 thru/or 4 and m32 and m33 express the integer of 2 thru/or 5, two or more R31, R32, and R33 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n31 expresses one or more integers.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to organic electroluminescence devices available in fields, such as a back light, a flat-panel display, the source of the illumination light, a display device, electrophotography, organic-semiconductor laser, the record light source, the exposure light source, the reading light source, an indicator, a signboard, and an optical-communication device.

[0002]

[Description of the Prior Art] Although researches and developments of various light emitting devices are done actively today, in it, the organic electroluminescence (EL) component has the features, such as super-thin shape and lightweight nature, high-speed responsibility, extensive angle-of-visibility nature, and a low-battery drive, and attracts attention as a promising light emitting device. Generally, the organic EL device consists of counterelectrodes of the pair the luminous layer and this whose layer were pinched, and the electron poured in from cathode and the electron hole poured in from the anode plate recombine it, and it uses luminescence from the generated exciton.

[0003] What has the laminated structure shown by Tang and others as an organic EL device which emits light in high brightness by current and the low battery is known (nonpatent literature 1 reference). When this component carries out the laminating of the ingredient which served both as an electronic transportation ingredient and luminescent material, and the hole transportation ingredient, green luminescence of high brightness has been obtained, it is the direct current voltage of 6-7V, and brightness has reached thousands cd/m². However, when a practical component is considered, development of the further high brightness and an efficient light emitting device is desired. The light emitting device which used the alt.metal-ized complex (Ir(ppy)₃:tris-ortho-iridated complex with 2-Phenylpyridine) of iridium as a luminescent material was reported as a component which can emit light recently still more efficient (nonpatent literature 2 reference). This light emitting device uses phosphorescence luminescence from a triplet exciton, that external quantum efficiency (luminous efficiency) is 8.3%, and exceeds 5% of external quantum efficiency called limitation conventionally, and it excels. Usually, the ratio of the singlet exciton which contributes to firefly luminescence, and the triplet exciton which contributes to phosphorescence luminescence is 1:3, and can improve luminous efficiency by using a triplet exciton. However, since it is limited to the green light emitting device, the alt.metal-ized complex of said iridium needs development of the component which emits light efficient also about other colors, especially blue, when applying to a full color display or a white light emitting device.

[0004] In the light emitting device using a triplet exciton like the alt.metal-ized complex of the above-mentioned iridium, if the minimum excitation triplet energy level of the host ingredient in a luminous layer is lower than luminescent material, since the luminous efficiency of a component will fall, the minimum excitation triplet energy level of a host ingredient must be made higher than that of luminescent material. When [the light emitting device which uses a triplet exciton especially excelled / when / in color purity] carrying out blue luminescence, the emission

spectrum of luminescent material becomes short wave, that is, the minimum excitation triplet energy level of this luminescent material becomes high. And the minimum excitation triplet energy level of luminescent material needs to follow on becoming high, and also needs to make high the minimum excitation triplet energy level of a host ingredient. If the minimum excitation triplet energy level of a host ingredient becomes high, charge impregnation nature will fall, and if it is going to maintain charge impregnation nature, driver voltage becomes high and may drop the endurance of a component. Therefore, in order to attain efficient luminescence in the light emitting device using a triplet exciton, development of the approach of pouring a charge into a host ingredient efficiently was desired. Moreover, it was thought that the minimum excitation triplet energy level of the layer which a luminous layer adjoins is also important for efficient luminescence, when the minimum excitation triplet energy level of the adjoining layer is lower than the minimum excitation triplet energy level of luminescent material, the triplet exciton generated in the host ingredient did not carry out energy transfer to luminescent material, but energy transfer carried out to the adjoining layer, and development of a component for which the layer which luminous efficiency may fall and adjoins does not bar the energy transfer to luminescent material was desired. Furthermore, development of the component excellent in the endurance at the time of high brightness luminescence was desired.

[0005]

[Nonpatent literature 1] Applied Physics Letters (Applied Physics Letters), 1987, 51 volumes, 913 pages [Nonpatent literature 2] Applied Physics Letters (Applied Physics Letters), 1999, 75 volumes, 4 pages [0006]

[Problem(s) to be Solved by the Invention] This invention makes it a technical problem to offer the organic electroluminescence devices which emit light with high luminous efficiency and emit light with the organic electroluminescence devices in which a low-battery drive is possible, especially luminous efficiency high also in a blue field in view of said many problems. Moreover, also let it be a technical problem to offer the organic electroluminescence devices which have high endurance also at the time of high brightness luminescence.

[0007]

[Means for Solving the Problem] this invention persons found out that efficient blue luminescence was realizable by making a conductive polymer adjoin a vacuum evaporation mold luminous layer, as a result of examining wholeheartedly the technique of carrying out efficient luminescence of the triplet blue light emitting device. That is, the above-mentioned technical problem is attained by the following means.

(1) They are the organic electroluminescence devices which have the luminous layer formed of vacuum evaporation between an anode plate and cathode, a luminous layer contains at least one sort of luminescent material which emits light from a triplet excitation state, have the adjacent layer which adjoins at least one side by the side of the anode plate of a luminous layer, and cathode, and are characterized by an adjacent layer containing a conductive polymer.

[0008] (2) Organic electroluminescence devices given in the above (1) to which the minimum excitation triplet energy level of luminescent material considers that it is [63 or more kcal/mol] 81 or less kcal/mol as the description.

(3) The above (1) characterized by the quantum yield of the phosphorescence of luminescent material being 0.5 or more, or organic electroluminescence devices given in (2).

(4) Organic electroluminescence devices given in either of above-mentioned (1) - (3) to which the minimum excitation triplet energy level of the luminous layer except luminescent material is characterized by 64 or more kcal/mol being 82 or less kcal/mol.

[0009] (5) Organic electroluminescence devices given in either of above-mentioned (1) - (4) characterized by the electrical conductivity of an adjacent layer being -one or more 10^{-6} S-cm.

(6) Organic electroluminescence devices given in either of above-mentioned (1) - (5) characterized by a conductive polymer being the disconjugation macromolecule or conjugation macromolecule which connected the terrorism ring with an aromatic series ring or aromatic series by the connection radical more than bivalence.

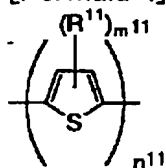
(7) Organic electroluminescence devices given in either of above-mentioned (1) - (6) characterized by being the conjugation macromolecule with which the conductive polymer had

the dopant doped.

(8) Organic electroluminescence devices given in either of above-mentioned (1) – (7) characterized by a conductive polymer having the substructure expressed with the following general formula (I). General formula (I)

[0010]

[Formula 4]

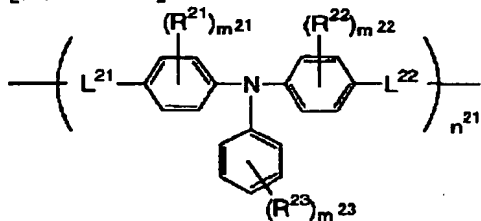


[0011] R11 expresses a substituent among a formula and m11 expresses the integer of 0 thru/or 2. When m11 expresses 2, two or more R11 may be mutually the same, or may differ, may be connected mutually, and may form a ring. n11 expresses one or more integers.

[0012] (9) Organic electroluminescence devices given in either of above-mentioned (1) – (6) characterized by a conductive polymer having the substructure expressed with the following general formula (II). General formula (II)

[0013]

[Formula 5]

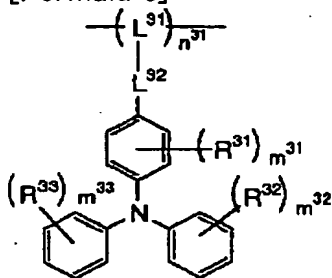


[0014] L21 and L22 express a divalent connection radical among a formula. R21, R22, and R23 express a substituent, m21 and m22 express the integer of 0 thru/or 4, and m23 expresses the integer of 0 thru/or 5. When m21 and m22 express the integer of 2 thru/or 4 and m23 expresses the integer of 2 thru/or 5, two or more R21, R22, and R23 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n21 expresses one or more integers.

[0015] (10) Organic electroluminescence devices given in either of above-mentioned (1) – (6) characterized by a conductive polymer having the substructure expressed with the following general formula (III). General formula (III)

[0016]

[Formula 6]



[0017] A connection radical trivalent in L31 and L32 express single bond or a divalent connection radical among a formula. R31, R32, and R33 express a substituent, m31 expresses the integer of 0 thru/or 4, and m32 and m33 express the integer of 0 thru/or 5. When m31 expresses the integer of 2 thru/or 4 and m32 and m33 express the integer of 2 thru/or 5, two or more R31, R32, and R33 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n31 expresses one or more integers.

[0018]

[Embodiment of the Invention] Hereafter, this invention is explained to a 1. The organic electroluminescence devices of this invention are organic electroluminescence devices which have the luminous layer of at least one layer in inter-electrode [of a pair], and it is characterized by for the adjacent layer of a luminous layer containing a conductive polymer, and containing at least one sort of luminescent material which a luminous layer is produced by vacuum deposition and emits light from a triplet excitation state. Although it can have an adjacent layer in both by the side of an anode plate or cathode to a luminous layer, having in an anode plate side is desirable. In this case, the minimum lamination of organic electroluminescence devices is an anode plate / adjacent layer / luminous layer / cathode (/: interface). The function and property for which it asks respond and you may have a hole impregnation layer, a hole transportation layer, an electron injection layer, an electronic transportation layer, a protective layer, etc. also in except, and these each class may be equipped with other functions, respectively, and an adjacent layer may be equipped with the function of these each class.

[0019] As for the electrical conductivity (unit: $S\text{-cm}^{-1}$) of an adjacent layer, it is desirable to consider as $-one$ or more $10^{-6} S\text{-cm}$, its $-one$ or more $10^{-3} S\text{-cm}$ is more desirable, and especially its $-one$ or more $10^{-1} S\text{-cm}$ is desirable. The charge impregnation transportability to a luminous layer can go up, and luminous efficiency can be raised, so that the electrical conductivity of an adjacent layer is high. Moreover, there is effectiveness also in stopping the driver voltage of a component. By this invention, by preparing an adjacent layer, since level arises between an electrode and a luminous layer, the charge impregnation to a luminous layer becomes is easy to be performed. Level puts ionization potential or an electron affinity here.

[0020] The conductive polymer contained in an adjacent layer by this invention is the disconjugation macromolecule or conjugation macromolecule which connected an aromatic series ring or aromatic series heterocycle by the connection radical more than single bond or bivalence preferably. Here, as an aromatic series ring, the benzene ring is mentioned, for example and a condensed ring may be formed further. Moreover, as aromatic series heterocycle, for example, a pyridine ring, a villa gin ring, a pyrimidine ring, a pyridazine ring, a triazine ring, an oxazole ring, a thiazole ring, an imidazole ring, an oxadiazole ring, a thiadiazole ring, a triazole ring, a tetrazole ring, a furan ring, a thiophene ring, a pyrrole ring, the Indore ring, a carbazole ring, a PENZO imidazole ring, an imidazo pyridine ring, etc. may be mentioned, a condensed ring may be formed further, and you may have a substituent. Moreover, as a connection radical more than the bivalence which connects an aromatic series ring or aromatic series heterocycle, the connection radical formed with single bond, a carbon atom, a silicon atom, a nitrogen atom, a boron atom, an oxygen atom, a sulfur atom, a metal, a metal ion, etc. is mentioned. It is the radical preferably formed from single bond, a carbon atom, a nitrogen atom, a silicon atom, a boron atom, an oxygen atom, sulfur atoms, and such combination, and the methylene group which is not permuted [a permutation or], a carbonyl group, an imino group, a sulfonyl group, a sulfinyl group, an ester group, an amide group, a silyl radical, etc. are mentioned as a radical formed of combination.

[0021] It is still more desirable that it is a conjugation macromolecule from a viewpoint which improves charge impregnation nature to a luminous layer, and gathers luminous efficiency as a conductive polymer. As an example of a conjugation giant molecule, polyacetylene, the poly diacetylene, Pori (PARAFENIREN), The poly fluorene, the poly azulene, Pori (PARAFENIRENSARUFAIDO), Polypyrrole, the poly thiophene, PORIISO thianaphthene, the poly aniline, Pori (PARAFENIREMBINIREN), Pori (2, 5-thienylene vinylene), A double chain type conjugated-system macromolecule, a metal phthalocyanines (poly peri naphthalene etc.) system macromolecule, and other conjugated-system macromolecules (Pori (PARAKI silylene), Pori [alpha-(5 and 5'-bithiophene diyl) benzylidene], etc.) are mentioned. They are Pori (PARAFENIREN), polypyrrole, the poly thiophene, the poly aniline, Pori (PARAFENIREMBINIREN), and Pori (2 and 5-thienylene vinylene is mentioned and Pori (PARAFENIREN), the poly thiophene, Pori (PARAFENIREMBINIREN), etc. are mentioned more preferably.) preferably. It is the conductive polymer which has especially the substructure expressed with the above-mentioned general formula (I) preferably as a conjugated-system macromolecule. R11 expresses

a substituent among the above mentioned general formula (I), and m11 expresses the integer of 0 thru/or 2. When m11 expresses 2, two or more R11 may be mutually the same, or may differ, may be connected mutually, and may form a ring.

[0022] as the substituent which R11 expresses -- an alkyl group (they are carbon numbers 1-8 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-12 --) for example, methyl, ethyl, iso-propyl, tert-butyl, n-octyl, n-DESHIRU, n-hexadecyl, cyclo propyl, cyclopentyl, cyclohexyl, etc. are mentioned. an alkenyl radical (they are carbon numbers 2-8 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-12 --) for example, vinyl, an allyl compound, 2-butenyl, 3-pentenyl, 2-hexenyl, 3-hexenyl, 4-hexenyl, 2-OKUTENIRU, etc. are mentioned. an alkynyl group (especially, it is carbon numbers 2-8 preferably, for example, propargyl, 3-cutting-pliers nil, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-12 --) an aryl group (they are carbon numbers 6-12 especially preferably desirable -- carbon numbers 6-30 -- more -- desirable -- carbon numbers 6-20 --) for example, phenyl, p-methylphenyl, naphthyl, etc. are mentioned. the amino group (especially, it is carbon numbers 0-6 preferably, for example, amino, methylamino, dimethylamino, diethylamino, dibenzylamino, diphenylamino, etc. are mentioned. desirable -- carbon numbers 0-20 -- more -- desirable -- carbon numbers 0-10 --) ** [0023] an alkoxy group (they are carbon numbers 1-8 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-12 --) for example, methoxy, ethoxy ** butoxy, hexyloxy one, octyloxy, etc. are mentioned. an aryloxy group (especially, it is carbon numbers 6-12 preferably, for example, phenyloxy, 2-naphthyloxy, etc. are mentioned. desirable -- carbon numbers 6-20 -- more -- desirable -- carbon numbers 6-16 --) an acyl group (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, acetyl, benzoyl, the formyl, pivaloyl, etc. are mentioned. an alkoxy carbonyl group (especially, it is carbon numbers 2-12 preferably, for example, methoxycarbonyl, ethoxycarbonyl, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) an aryloxy carbonyl group (desirable -- carbon numbers 7-20 -- more -- desirable -- carbon numbers 7-16 -- especially, it is carbon numbers 7-10 preferably, for example, phenyloxy carbonyl etc. is mentioned.), [0024] an acyloxy radical (they are carbon numbers 2-10 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) for example, acetoxyl, benzoyloxy one, etc. are mentioned. the acylamino radical (especially, it is carbon numbers 2-10 preferably, for example, acetylamino, benzoylamino, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) an alkoxycarbonylamino radical (they are carbon numbers 2-12 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) for example, methoxycarbonylamino etc. is mentioned. an aryloxy carbonylamino radical (especially, it is carbon numbers 7-12 preferably, for example, phenyloxy carbonylamino etc. is mentioned. desirable -- carbon numbers 7-20 -- more -- desirable -- carbon numbers 7-16 --) a sulfonylamino radical (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, methanesulfonylamino, benzenesulphonyl amino, etc. are mentioned. a sulfamoyl group (especially, it is carbon numbers 0-12 preferably, for example, sulfamoyl, methyl sulfamoyl, dimethyl sulfamoyl, phenyl sulfamoyl, etc. are mentioned. desirable -- carbon numbers 0-20 -- more -- desirable -- carbon numbers 0-16 --) ** [0025] a carbamoyl group (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, carbamoyl, methyl carbamoyl, diethylcarbamoyl, phenylcarbamoyl, etc. are mentioned. an alkylthio group (especially, it is carbon numbers 1-12 preferably, for example, a methylthio, ethyl thio, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) an aryl thio radical (they are carbon numbers 6-12 especially preferably desirable -- carbon numbers 6-20 -- more -- desirable -- carbon numbers 6-16 --) for example, phenylthio etc. is mentioned. a sulfonyl group (especially, it is carbon numbers 1-12 preferably, for example, mesyl, tosyl, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) a sulfinyl group (especially, it is carbon numbers 1-12 preferably, for example, methane sulfinyl,

benzene sulfinyl, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) an ureido radical (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, ureido, methyl ureido, phenyl ureido, etc. are mentioned. a phosphoric-acid amide group (especially, it is carbon numbers 1-12 preferably, for example, a diethyl phosphoric-acid amide, a phenyl phosphoric-acid amide, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) ** [0026] a hydroxy group, a sulfhydryl group, a halogen atom (for example, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom), a cyano group, a sulfonic group, a carboxyl group, a nitro group, a hydroxamic acid radical, a SURUFINO radical, a hydrazino radical, an imino group, and a heterocycle radical (desirable -- carbon numbers 1-20 -- it is carbon numbers 1-12 more preferably, and a nitrogen atom, an oxygen atom, and a sulfur atom are mentioned as a hetero atom, for example.) Specifically For example, a pyrrolidine, a piperidine, a piperazine, morpholine, A thiophene, a furan, a pyrrole, an imidazole, a pyrazole, a pyridine, Pyrazine, pyridazine, triazole, triazine, Indore, indazole, A pudding, thiazoline, a thiazole, thiadiazole, oxazoline, Oxazole, OKISA diazole, a quinoline, an isoquinoline, phthalazine, a NAFUCHI lysine, quinoxaline, quinazoline, cinnoline, a pteridine, an acridine, a phenanthroline, phenazine, tetrazole, benzimidazole benzoxazole, a bends thiazole, benzotriazol, a TETORAZA indene, etc. are mentioned. a silyl radical (desirable -- carbon numbers 3-40 -- more -- desirable -- 3-30 -- especially, it is 3-24 preferably, for example, trimethylsilyl, triphenyl silyl, etc. are mentioned.) etc. is mentioned.

[0027] The above-mentioned substituent may be permuted further. moreover, when it has two or more substituents, even if those substituents are mutually the same, they may differ, and when possible, it may connect, and a ring may be formed. As a ring formed, the benzene ring, a thiophene ring, a dioxane ring, a dithiane ring, etc. are mentioned.

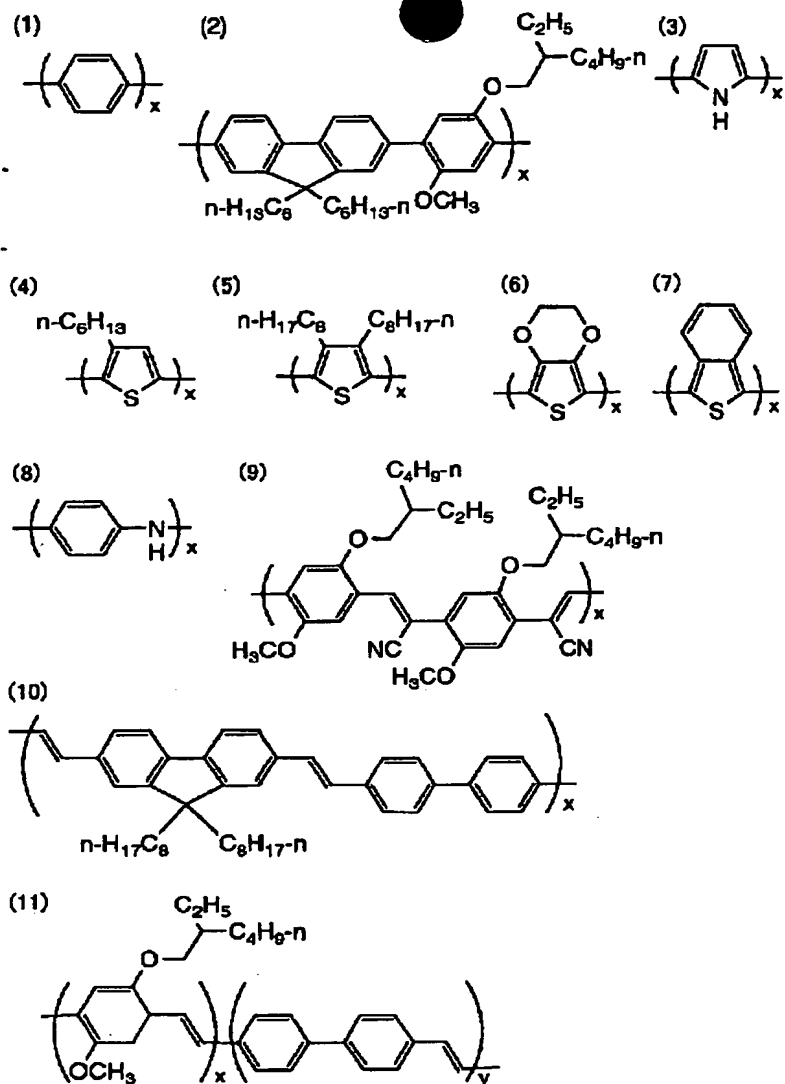
[0028] As a substituent which R11 expresses, it is an alkyl group, an alkenyl radical, an alkynyl group, an alkoxy group, and an alkylthio group preferably, and they are an alkyl group, an alkoxy group, and an alkylthio group still more preferably. Especially, preferably, when m11 is 2, it is the alkoxy group and alkylthio group in which two R11 formed the ring, for example, a dioxane ring, a dithiane ring, etc. are mentioned. R11 is an alkyl group when m11 is 1 (the alkyl group of carbon numbers 2-8 is desirable). moreover, the stereo which connected all the connection formats with the adjacent thiophene ring by 2-5' when R11 was Pori (3-alkyl thiophene) which is an alkyl group -- although there are a regular thing and what [solid irregularity-/ a thing] in which 2-2' and 5-5' connection are included, a three-dimensional irregular thing is desirable.

[0029] the inside of the above-mentioned general formula (I), and n11 -- desirable -- 10-10000 -- more -- desirable -- 50-5000 -- it is the integer of 50-1000 especially preferably.

[0030] Although the example of a conjugated-system macromolecule is shown below, this invention is not limited to these. Moreover, the compound of WO98/01909 publication etc. is mentioned other than these.

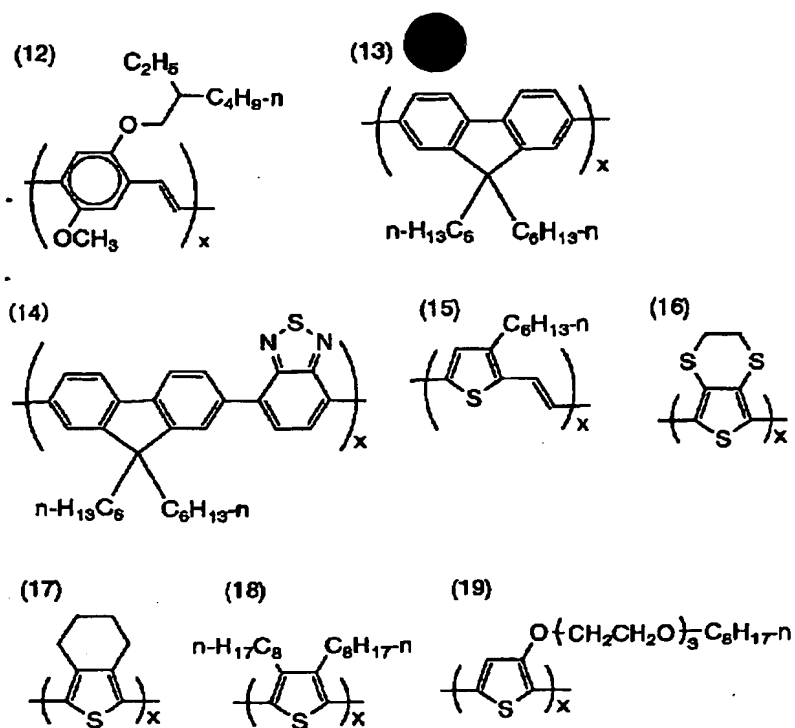
[0031]

[Formula 7]



[0032]

[Formula 8]



[0033] The conductive polymer which has the substructure expressed with the above-mentioned general formula (II) or the above-mentioned general formula (III) as a disconjugation macromolecule is desirable. R21, R22, R23, R31, R32, and R33 express a substituent among the above-mentioned general formula (II) or the above-mentioned general formula (III), and this substituent is synonymous with R11 in the above-mentioned general formula (I). m21, m22, and m31 express the integer of 0 thru/or 4, and m23, m32, and m33 are the integers of 0 thru/or 5. When m21 expresses two or more integers, two or more R21 may be mutually the same, or may differ, may be connected mutually, and may form a ring (the same is said of two or more R22, R23, R31, R32, and R33 which exist when m22, m23, m31, m32, and m33 express two or more integers). The ring to form is an aromatic series ring or ring heterocycle preferably. It is a connection radical divalent in L21, L22, and L32, and a connection radical trivalent in L31, and is the radical formed from an aromatic series ring, aromatic series heterocycle, a carbon atom, a nitrogen atom, a silicon atom, a boron atom, an oxygen atom and sulfur atoms, or such combination, and the methylene group which is not permuted [a permutation or, an aromatic series ring radical, a carbonyl group, an imino group, a sulfonyl group, a sulfinyl group an ester group, an amide group, etc. be mentioned as a radical formed from combination.

[0034] In a general formula (II), R21, R22, and R23 are an alkyl group, an alkoxy group, and an aryl group preferably, and are an alkyl group and an aryl group more preferably. When m21, m22, and m23 express two or more integers, two or more R21, R22, and R23 may be connected mutually, respectively, and they may form a ring, the ring formed is desirable and an aromatic series ring, aromatic series heterocycle, etc. are mentioned. R23 is an aromatic series ring which has a diaryl amino group as a substituent preferably especially. L21 and L22 are radicals which consist of the methylene group which is not permuted [a permutation or], a carbonyl group, a sulfonyl group, a sulfinyl group, an ester group, an aromatic series ring, silyl radicals, or such combination preferably.

[0035] In a general formula (III), R31, R32, and R33 are an alkyl group, an alkoxy group, and an aryl group preferably, and are an alkyl group and an aryl group more preferably. When m31, m32, and m33 express two or more integers, two or more R31, R32, and R33 may be connected mutually, respectively, and they may form a ring, the ring formed is desirable and an aromatic series ring, aromatic series heterocycle, etc. are mentioned. R33 is an aromatic series ring which has a diaryl amino group as a substituent preferably especially. L21 and L22 are radicals which consist of the methylene group which is not permuted [a permutation or], a carbonyl group, a

sulfonyl group, a sulfinyl group, an ester group, an aromatic series ring, silyl radicals, or such combination preferably.

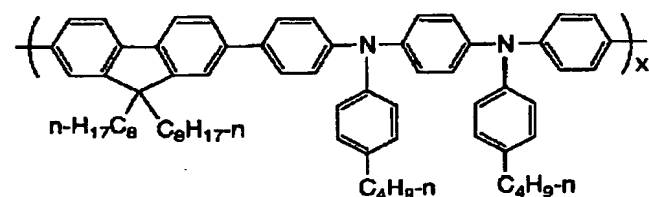
[0036] n21 and n31 -- desirable -- 5-5000 -- more -- desirable -- 20-2000 -- it is the integer of 20-1000 especially preferably.

[0037] Although the example of a non-conjugated-system macromolecule is shown below, this invention is not limited to these. Moreover, the compound of a publication etc. is mentioned to patent No. 310989, JP,7-188398,A, JP,8-188773,A, JP,8-269446,A, JP,8-295880,A, JP,2000-80167,A, JP,2000-150169,A, JP,2001-208087,A, JP,2002-75654,A, JP,2002-117982,A, JP,2002-117983,A, the ** table No. 506481 [2002 to], etc. also at everything but these.

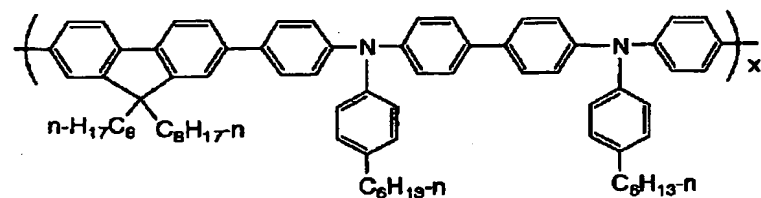
[0038]

[Formula 9]

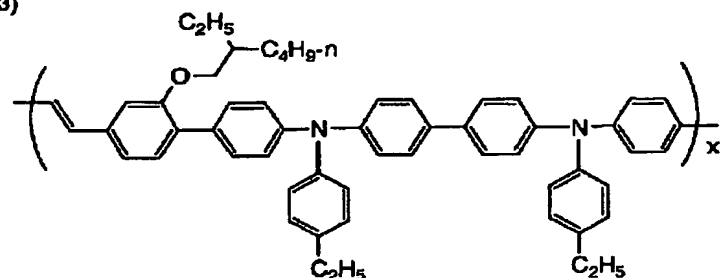
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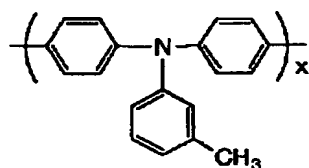
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(A-3)



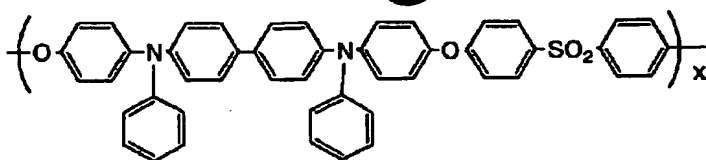
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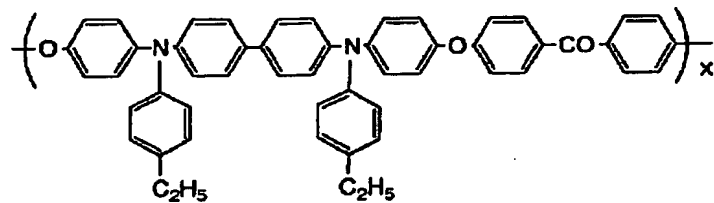
[0039]

[Formula 10]

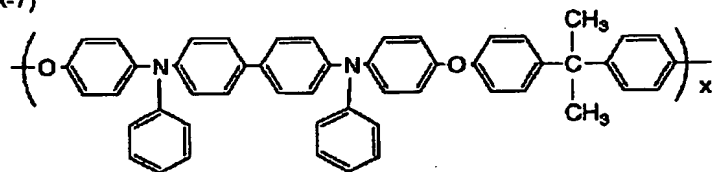
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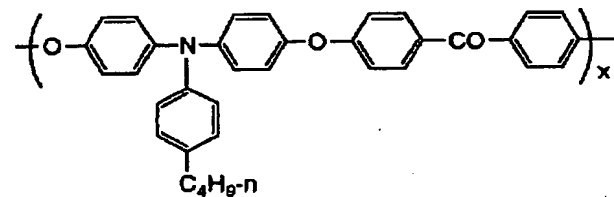
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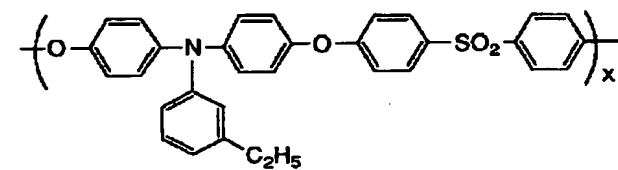
(A-7)



(A-8)



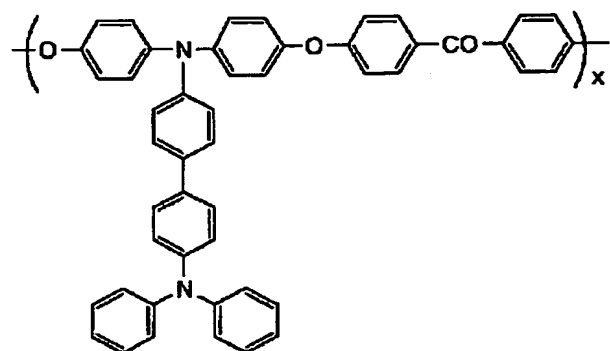
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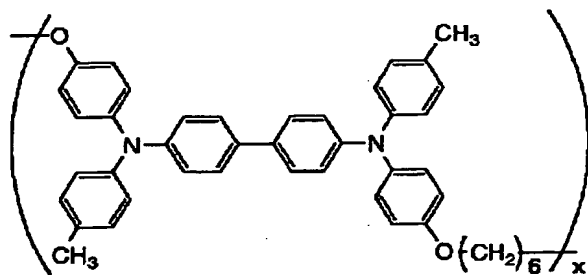
[0040]

[Formula 11]

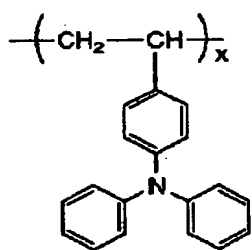
(A-10)



(A-11)



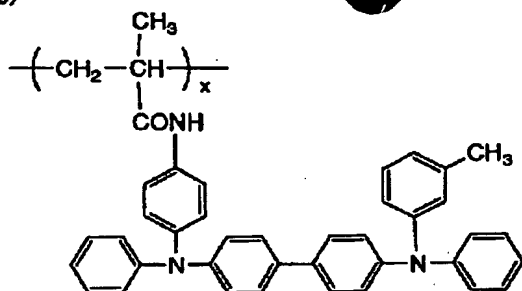
(A-12)



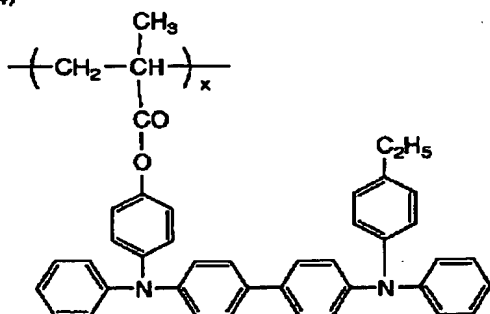
[0041]

[Formula 12]

(A-13)



(A-14)



[0042] 1000-1 million are desirable, and are 10000-500000 more preferably, and the weight average molecular weight of the conductive polymer used by this invention is 10000-100000 still more preferably.

[0043] As for the viewpoint which raises the electrical conductivity of an adjacent layer, improves the charge impregnation nature to a luminous layer further, and gathers luminous efficiency to a conductive polymer, it is desirable to contain a kind of dopant at least, and it is more desirable to make said conjugation macromolecule contain a dopant. As a dopant contained in a conductive polymer, an electronic receptiveness (acceptor) dopant and an electron-donative (donor) dopant are mentioned.

[0044] As an example of an electronic receptiveness (acceptor) dopant A halogen (Cl₂, Br₂, I₂, ICl, ICl₃, IBr, IF), Lewis acid (PF₅, AsF₅, SbF₅, BF₃, BCl₃, BBr₃, SO₃), Proton acid (H HF, HCl, HNO₃, H₂ SO₄, HClO₄, FSO₃ ClSO₃ H, CF₃SO₃ H, various organic acids, amino acid, etc.), a transition-metals compound (FeCl₃, FeOCl, and TiCl₄, ZrCl₄, HfCl₄, NbF₅, NbCl₅, TaCl₅, MoF₅, MoCl₅, WF₆, WCl₆, UF₆ and LnCl₃ (lanthanoidses, such as Ln=La, and Ce, Pr, Nd, Sm) — An electrolyte anion (Cl⁻, Br⁻, I⁻, ClO₄⁻, PF₆⁻, AsF₆⁻, SbF₆⁻, BF₄⁻, various sulfonic-acid anions), In addition to this (SbCl(NO₂⁺)₆⁻) (BF(NO₂⁺)₄⁻) (O₂, XeOF₄ (SbF(NO₂⁺)₆⁻), FSO₂SO₂F, AgClO₄, H₂IrCl₆, and La(NO₃)₃·6H₂O grade are mentioned.)

[0045] as the example of an electron-donative (donor) dopant — alkali metal (Li, Na, K, Rb, Cs), alkaline earth metal (calcium, Sr, Ba), and lanthanoidses (Eu etc.) — in addition — (R₄N⁺, R₄P⁺, R₄As⁺, R₃S⁺, acetylcholine) etc. — it is mentioned.

[0046] As a combination of a dopant and said conjugation polymeric materials For example, polyacetylene, Pori (p-phenylene), such as I₂, AsF₅, and FeCl₃, AsF₅, K, AsF₆⁻, etc., The poly thiophene and ClO₄⁻, such as polypyrrole and ClO₄⁻, polystyrene sulfonate, PORISO thianaphthenes, such as a nitroso NIUMU salt, an aminium salt, and quinones, I₂, etc., Pori (p-phenylene sulfide), AsF₅ and Pori (p-phenylene oxide), AsF₅ and the poly aniline, HCl, etc., Pori (p-phenylenevinylene), poly thio phenylenevinylene, such as H₂SO₄, nickel phthalocyanines, such as I₂, and **, such as I₂, are mentioned.

[0047] Moreover, a conductive polymer may be an ion conductive polymer which doped the electrolyte to the macromolecule chain, as an example of a macromolecule chain, polyethers (polyethylene oxide, polypropylene oxide, etc.), polyester (polyethylene succinate, Polly beta propiolactone, etc.), polyamine (polyethyleneimine etc.), polysulfides (polyalkylene sulfide etc.), etc. are mentioned, and various alkali-metal salts etc. are mentioned as a doped electrolyte.

[0048] As alkali-metal ion which constitutes said alkali-metal salt, F^- , Cl^- , I^- , NO_3^- , SCN^- , ClO_4^- , $CF_3SO_3^-$, BF_4^- , AsF_6^- , BPh_4^- , etc. are mentioned as an anion in which Li^+ , Na^+ , K^+ , Rb^+ , Cs^+ , etc. form an opposite salt.

[0049] as the combination of a giant-molecule chain and an alkali-metal salt -- polyethylene oxide and $LiCF_3$ -- polyethylene succinate, such as SO_3 and $LiClO_4$, $LiClO_4$, $LiBF_4$ and Polly beta propiolactone, polyethyleneimine, such as $LiClO_4$, and $NaCF_3$ -- polyalkylene sulfides, such as SO_3 and $LiBF_4$, $AgNO_3$, etc. are mentioned. [for example,]

[0050] As for an adjacent layer, in the organic electroluminescence devices of this invention, it is desirable that a film is produced by spreading from a viewpoint of the improvement in endurance of a light emitting device. Moreover, the film production by spreading also from a viewpoint of the simple nature of component production that spreading is possible for a large area at once is desirable. For this reason, the conductive polymer contained in an adjacent layer has especially the desirable thing that can be applied by the organic solvent.

[0051] Next, the ingredient which forms a luminous layer is explained. Oneself contributes the luminescent material contained for the component of this invention to luminescence of a light emitting device, and at least one sort is a triplet luminescent material which emits light from a triplet excitation state. As a triplet luminescent material, what emits light from a triplet excitation state in ordinary temperature is desirable, and transition metal complexes which have an aromatic series ring thru/or aromatic series heterocycle as a ligand more preferably, such as an aromatic series ring thru/or aromatic series heterocycle, etc. containing a heavy atom, are mentioned.

[0052] Although not limited especially as a transition-metals atom which constitutes a transition metal complex, it is a ruthenium, a rhodium, palladium, a tungsten, a rhenium, iridium, and platinum, and they are a ruthenium, a rhenium, iridium, and platinum more preferably. As a ligand of a transition metal complex, for example, work, such as G.Wilkinson, "Comprehensive Coordination Chemistry" Pergamon Press It will publish in 1987. H.Yersin work "Photochemistry and Photophysics of Coordination Compounds" Springer-Verlag It will publish in 1987. Akio Yamamoto work "an organic metal chemistry-foundation and application --" Shokabo Publishing Co., Ltd. 1982 issue The ligand of a publication is mentioned. etc. -- preferably a halogen ligand (preferably chlorine ligand) and a nitrogen-containing heterocycle ligand (for example, a phenyl pyridine --) They are diketone ligands (for example, acetylacetone etc.), such as benzoquinoline, quinolinol, a bipyridyl, and a phenanthroline, carboxylic-acid ligands (for example, acetic-acid ligand etc.), a carbon monoxide ligand, an isonitrile ligand, and a cyano ligand.

[0053] As a transition metal complex, an alt.metal-ized metal complex is desirable. an alt.metal-ized metal complex -- for example, "an organic metal chemistry-foundation and application" - p150 and 232 Shokabo Publishing Co., Ltd. Akio Yamamoto work The 1982 issue and "Photochemistry and Photophysics of Coordination Compounds" p71-77 and p135-146 Springer-Verlag H.Yersin work 1987 issue etc. -- it is the generic name of the compound group indicated. It is the light emitting device ingredient which consists of an alt.metal-ized iridium complex (orthometalated Ir Complexes) preferably especially.

[0054] Trivalent is desirable although especially the valence of the iridium of an alt.metal-ized iridium complex is not limited. The ligand of an alt.metal-ized iridium complex is an aryl group permutation nitrogen-containing heterocycle derivative (the permutation location of an aryl group is on the contiguity carbon of a nitrogen-containing heterocycle nitrogen atom, and as an aryl group, a phenyl group, a naphthyl group, an anthryl radical, a phenan tolyl group, a pyrenyl radical, etc. are mentioned, and it may form a ring, heterocycle, and a condensed ring further.), for example, although it will not ask especially if an alt.metal-ized complex can be formed. As nitrogen-containing heterocycle, it is the hetero aryl group permutation nitrogen-containing heterocycle derivative (the permutation location of a hetero aryl group is on the contiguity carbon of a nitrogen-containing heterocycle nitrogen atom.) with which a pyridine, a pyrimidine, pyrazine, pyridazine, a quinoline, an isoquinoline, quinoxaline, phthalazine, quinazoline, a NAFUCHI lysine, cinnoline, peri MIJIN, a phenanthroline, a pyrrole, an imidazole, a pyrazole, oxazole, OKISA diazole, triazole, thiadiazole, benzimidazole benzoxazole, a bends thiazole, phenanthridine, etc. mentioned, for example 7, 8-benzoquinoline and phosphino aryl with which the radical which

14/23
contains the aforementioned nitrogen-containing heterocycle derivative and hetero aryl group, for example, a thienyl group, a furil radical, etc. are mentioned, phosphino hetero aryl, a phosphino KISHIA reel, phosphino KISHIHETEROARIRU, aminomethyl aryl, aminomethyl hetero aryls, these derivatives, etc. are mentioned. Preferably Aryl group permutation nitrogen-containing aromatic series heterocycle, hetero aryl group permutation nitrogen-containing aromatic series heterocycle, They are 7 and 8-benzoquinolines and these derivatives. A phenyl pyridine, A thienyl pyridine, 7, 8-benzoquinoline, a benzyl pyridine, a phenyl pyrazole, The phenyl substitution products and these derivatives of the azole which has a phenyl isoquinoline and two nitrogen atoms or more are still more desirable, and the aromatic series heterocycle which the aryl group with an electronic suction nature machine (for example, a halogen atom, a cyano group, an azole radical) permuted, and especially its derivative are desirable.

[0055] The above-mentioned thing is included. As an example of triplet luminescent material For example, JP,2001-181616,A, Provisional publication of a patent No. 181617 [2001 to], provisional publication of a patent No. 247859 [2001 to], an application for patent No. 89274 [2000 to], JP,2002-203679,A, JP,2002-241751,A, JP,2002-117978,A, JP,2002-170684,A, an application for patent No. 239281 [2001 to], an application for patent No. 248165 [2001 to], A compound WO 00/No. 57676, WO 00/No. 70655, WO01 / No. 39234A2, WO01 / No. 41512A1, and given in US6097147 No. A etc. is mentioned.

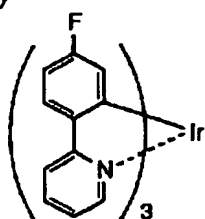
[0056] Although it is not limited, when the application to a full color display etc. is taken into consideration, as for especially the emission spectrum of the organic electroluminescence devices of this invention, it is desirable that it is 500nm or less (blue luminescence) about luminescence maximum wave length. As a luminescent material, it is desirable that the minimum excitation triplet energy level (T1 level) is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 55 kcal/mol (230 kJ/mol), and in order to consider as a blue light emitting device, it is desirable that it is especially below 81 kcal/mol (340 kJ/mol) more than 63 kcal/mol (264 kJ/mol). Furthermore, in order to raise the luminous efficiency of a component, the quantum yield of the phosphorescence of luminescent material is 0.5 (0.7 or more [0.6 or more / Preferably / especially preferably]) or more preferably.

[0057] The following examples are given as a desirable luminescent material in this invention.

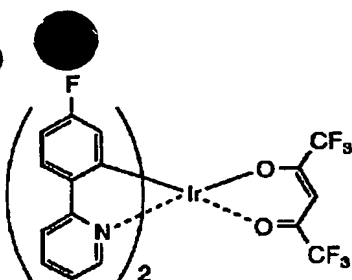
[0058]

[Formula 13]

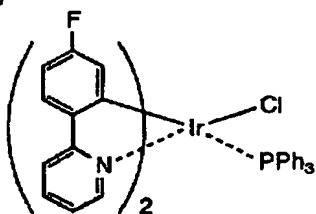
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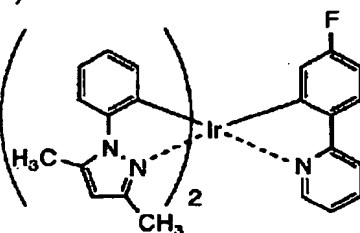
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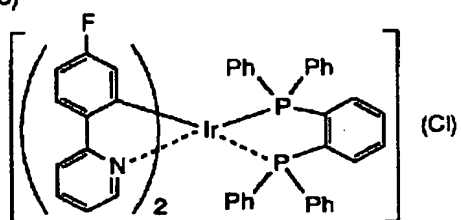
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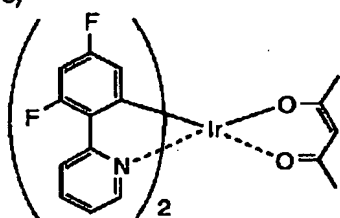
(D-4)



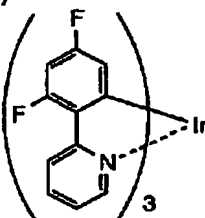
(D-5)



(D-6)

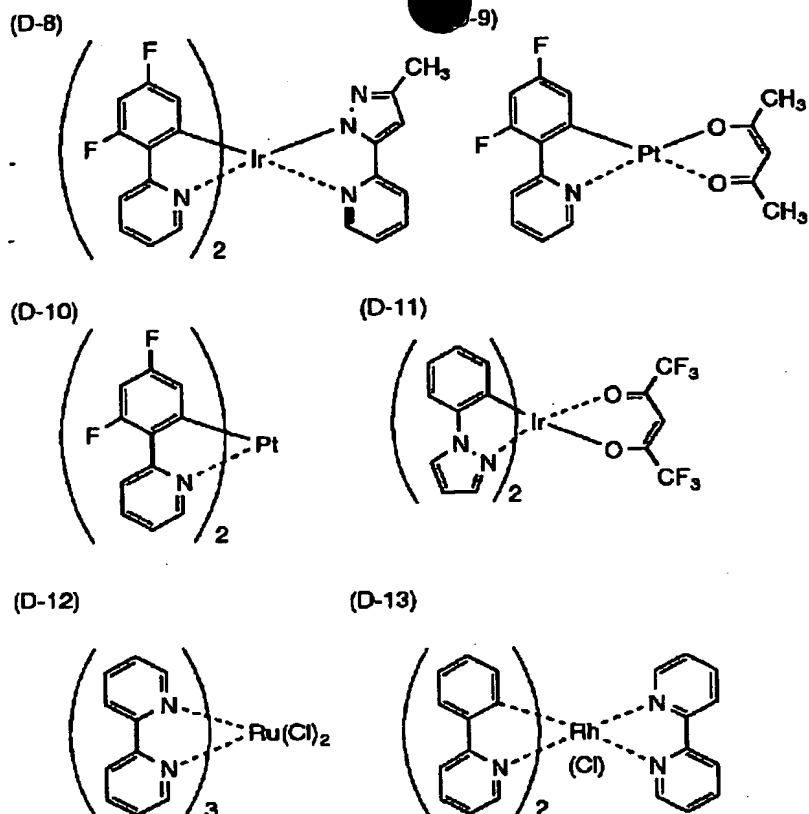


(D-7)



[0059]

[Formula 14]



[0060] Next, a host ingredient is explained. A host ingredient is what forms a luminous layer with luminescent material. At the time of electric-field impression An anode plate or a hole-injection layer, It has the function to pour an electron hole into a luminous layer from an electron hole transportation layer, and to pour an electron into a luminous layer from cathode or an electron injection layer, and an electronic transportation layer. You move the charge furthermore poured in within a luminous layer, an electron hole and an electron make it recombine, and it has the function to hand over the generated exciton of an electron and an electron hole pair to luminescent material, and to make luminescent material emit light. It will not be limited especially if it has the above-mentioned function as a host ingredient. As a compound used for the organic electroluminescence devices of this invention as a host ingredient For example, a carbazole, Indore, a pyrrole, a pyrazole, an imidazole, A benzimidazole pyrazolo pyridine, an imidazolo pyridine, imidazolo pyrazine, A nitrogen-containing heterocycle compound like benzimidazole benzo oxazole, benzimidazole, and benzothiazole, A ** sulfur heterocycle compound like a thiophene and a bends thiophene, styryl benzene, polyphenyl, a diphenyl butadiene, a fluorene, and an aromatic series condensed ring carbocyclic compound (naphthalene --) Tetra-phenyl butadienes, such as an anthracene and a pyrene, North America Free Trade Agreement RUIMIDO, Coumarin, perylene, and peri non, OKISA diazole, aldazine, PIRARIJIN, A cyclopentadiene, a bis-styryl anthracene, Quinacridone, a pyrrolo pyridine, A thiadiazolo pyridine, a styryl amine, an aromatic dimethyldyne compound, The metal complex of an aniline derivative like a thoria reel amine compound and a dialkyl aniline compound and an eight-quinolinol derivative, various metal complexes, the above-mentioned derivative which are represented by an organometallic complex and the rare earth complex, etc. are mentioned.

[0061] The host ingredient itself may emit light by the generated exciton. In that case, although a permissible luminescence region changes by the luminescence region of the request from the whole component, what has luminescence in a green region from ultraviolet as host ingredient independent film is usually desirable. As such a host ingredient, nitrogen-containing heterocycles, such as a carbazole, Indore, a pyrrole, a benzimidazole pudding, a benzimidazole pyrazolo pyridine, an imidazolo pyridine, and imidazolo pyrazine, a 2 permutation aniline compound, a thiophene compound, polyphenyls and these derivatives, or an organometallic

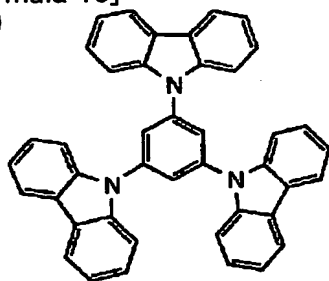
complex is mentioned preferably. An ingredient given in JP,2002-100476, mentioned still more preferably as a host ingredient. Moreover, in this invention, as described above, the luminous layer which consists of a host ingredient and luminescent material adjoins the layer containing a conductive polymer.

[0062] What has the larger excitation triplet energy level (T1 level) of the ingredient (host ingredient) except luminescent material than T1 level of luminescent material is desired among the ingredients which form a luminous layer. By making T1 level of a host ingredient larger than T1 level of luminescent material, the exciton generated with the host ingredient moves to luminescent material, the probability to cause luminescence becomes high, and luminous efficiency improves. Therefore, as a luminous layer except luminescent material, as for T1 level, it is desirable that it is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 55 kcal/mol (230 kJ/mol). Especially in the case of a blue light emitting device, it is below 82 kcal/mol (344 kJ/mol) (it is 67kcal (280 kJ/mol)/mol especially preferably 65 kcal/mol (272 kJ/mol) more preferably as a lower limit) more than more than 64 kcal/mol (268 kJ/mol) preferably.

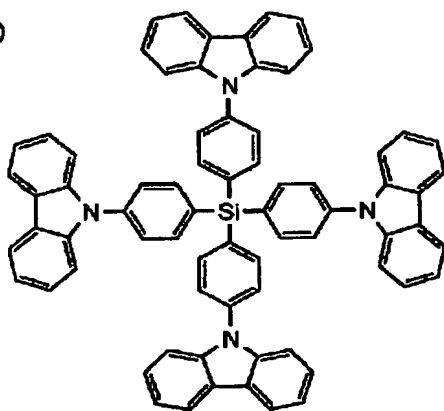
[0063] The following examples are given as a desirable host ingredient in this invention.

[0064]

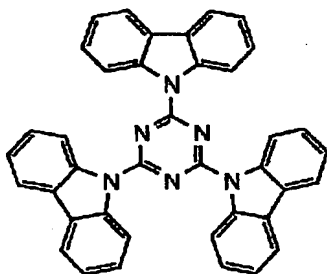
[Formula 15]
(H-1)



(H-2)

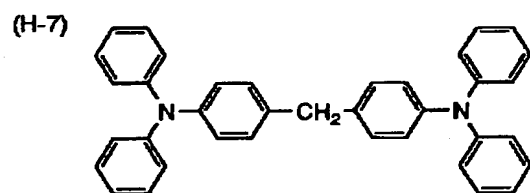
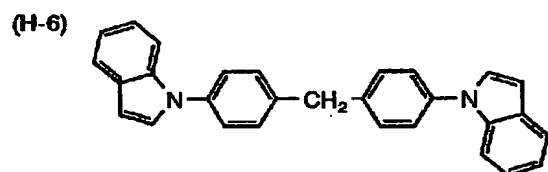
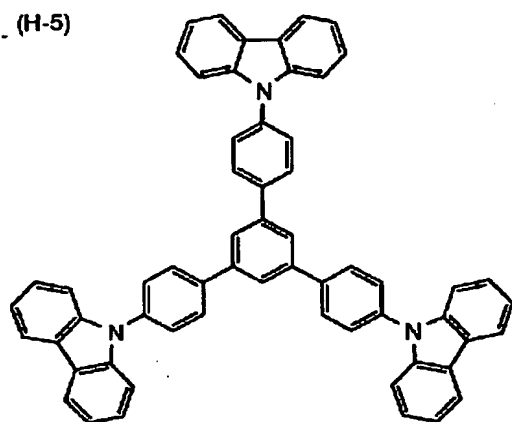
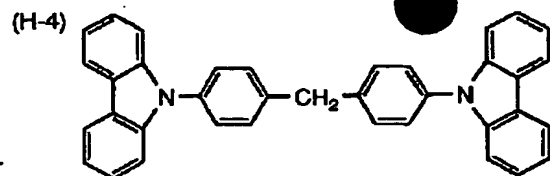


(H-3)



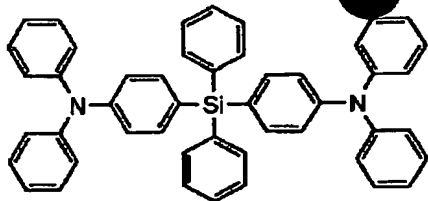
[0065]

[Formula 16]

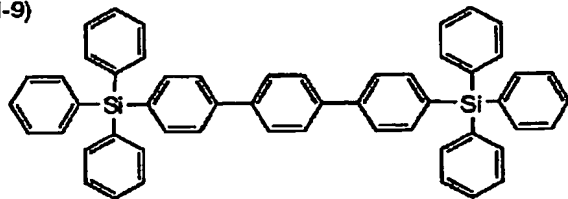


[0066]
[Formula 17]

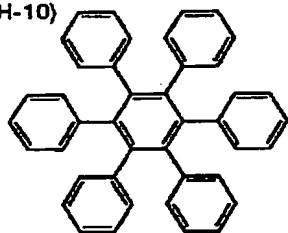
(H-8)



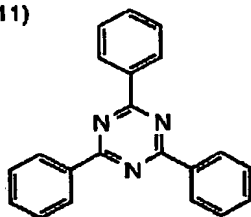
(H-9)



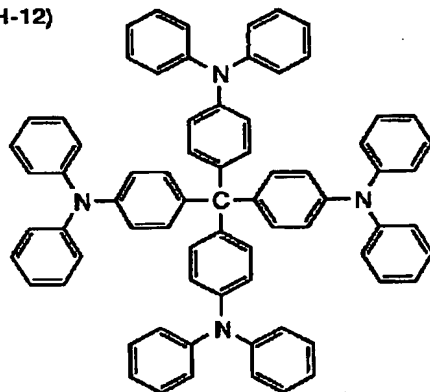
(H-10)



(H-11)



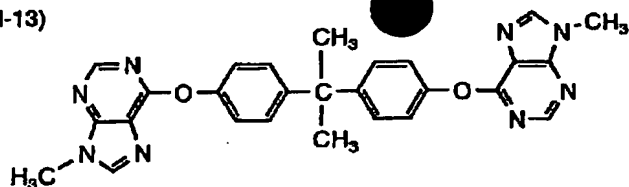
(H-12)



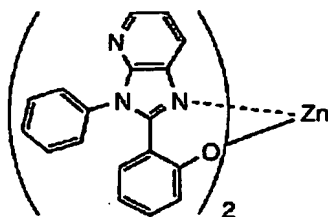
[0067]

[Formula 18]

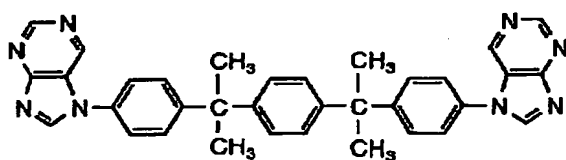
(H-13)



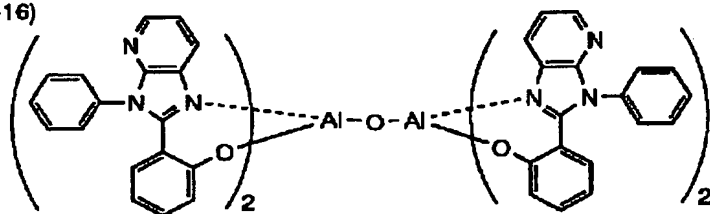
(H-14)



(H-15)



(H-16)



[0068] The luminous layer of the organic electroluminescence devices of this invention is produced by vacuum deposition. By producing a film with vacuum deposition, efficient luminescence is possible compared with the applying method etc. Resistance heating vacuum deposition etc. is mentioned as vacuum deposition.

[0069] Although a luminous layer consists of an above-mentioned luminescent material and an above-mentioned host ingredient, it may contain the electronic transportation ingredient illustrated in the further below-mentioned electronic transportation layer. Although especially the thickness of a luminous layer is not limited, usually the thing of the range of 1nm - 5 micrometers is desirable, and is 5nm - 1 micrometer more preferably, and it is 10nm - 500nm still more preferably.

[0070] Next, layers other than the adjacent layer containing a conductive polymer in the organic electroluminescence devices of this invention and a luminous layer are explained. An anode plate can supply an electron hole to a hole-injection layer, an electron hole transportation layer, a luminous layer, etc., a metal, an alloy, a metallic oxide, electrical conductivity compounds, or such mixture can be used, and a work function is an ingredient 4eV or more preferably. As an example, conductive metallic oxide, such as tin oxide, a zinc oxide, indium oxide, and indium tin oxide (ITO), To metals, such as gold, silver, chromium, and nickel, and a pan, or the mixture of these metals and conductive metallic oxide, Or inorganic conductivity matter, such as laminated material, copper iodide, and copper sulfide, the poly aniline, Organic conductivity ingredients, such as the poly thiophene and polypyrrole, the laminated material of these and ITO, etc. are mentioned, preferably, it is conductive metallic oxide and ITO is desirable from viewpoints, such as productivity, high conductivity, and transparency, especially. Although the thickness of an anode plate is selectable suitably by the ingredient, usually the thing of the range of 10nm - 5 micrometers is desirable, and is 50nm - 1 micrometer more preferably, and it is 100nm - 500nm still more preferably.

[0071] What usually carried out the stratification of the anode plate on this substrate, using soda lime glass, alkali free glass, and transparence resin as a substrate is used. As a substrate, when

using glass, in order to lessen the elution ion from glass, about the quality of the material, it is desirable to use alkali free glass. Moreover, when using soda lime glass, it is desirable to use what gave barrier coating sealant, such as a silica. If the thickness of a substrate is sufficient thickness to maintain a mechanical strength, there will be especially no limit, but in using glass, it usually uses a thing 0.7mm or more preferably 0.2mm or more.

[0072] Although various approaches are used for production of an anode plate with an ingredient, in ITO, film formation is carried out by approaches, such as spreading of an electron beam method, the sputtering method, resistance heating vacuum deposition, chemical reaction methods (sol-gel method etc.), and the distributed object of ITO, for example. By processing of washing and others, the driver voltage of a component is lowered or an anode plate can also raise luminous efficiency. For example, in ITO, UV-ozonization, plasma treatment, etc. are effective.

[0073] Cathode supplies an electron to an electron injection layer, an electronic transportation layer, a luminous layer, etc., and is chosen in consideration of adhesion with the layer which adjoins cathode, such as an electron injection layer, an electronic transportation layer, and a luminous layer, ionization potential, stability, etc. As an ingredient of cathode, a metal, an alloy, a metallic oxide, electrical conductivity compounds, or such mixture can be used. As an example, alkali metal (for example, Li, Na, K, Cs, etc.) or the fluoride of those, The oxide, alkaline earth metal (for example, Mg, calcium, etc.), or the fluoride of those, The oxide, gold, silver, lead, aluminum, a sodium-potassium alloy, Or those mixed metals, lithium-aluminium alloys, or those mixed metals, Rare earth metals, such as magnesium-silver alloys or those mixed metals, an indium, and an ytterbium, are mentioned. A work function is an ingredient 4eV or less preferably, and they are aluminum, lithium-aluminium alloys or those mixed metals, magnesium-silver alloys, or those mixed metals more preferably. Although the thickness of cathode is selectable suitably by the ingredient, usually the thing of the range of 10nm - 5 micrometers is desirable, and is 50nm - 1 micrometer more preferably, and it is 100nm - 1 micrometer still more preferably.

[0074] Approaches, such as an electron beam method, the sputtering method, resistance heating vacuum deposition, and a coating method, are used for production of cathode, and vapor-depositing a metal alone can also vapor-deposit two or more components to coincidence. Furthermore, the alloy which is possible also for vapor-depositing two or more metals to coincidence, and forming an alloy electrode, and was adjusted beforehand may be made to vapor-deposit. The lower one of the sheet resistance of an anode plate and cathode is desirable, and below its hundreds of ohms / ** are desirable.

[0075] The ingredient of a hole-injection layer and an electron hole transportation layer should just have the function to pour in an electron hole from an anode plate, the function to convey an electron hole, or the function that carries out the obstruction of the electron poured in from cathode. As the example, a carbazole, an imidazole, triazole, Oxazole, OKISA diazole, the poly aryl alkane, pyrazoline, A pyrazolone, a phenylenediamine, arylamine, an amino permutation chalcone, a styryl anthracene and full -- me -- non, a hydrazone, a stilbene, and a silazane -- An aromatic series tertiary-amine compound, a styryl amine, an aromatic dimethyldiyne compound, Conductive polymer oligomer, such as a porphyrin system compound, a polysilane system compound, Pori (N-vinylcarbazole), an aniline system copolymer, thiophene oligomer and a polymer, and the poly thiophene, and a polymer, the carbon film, the above-mentioned derivative, etc. are mentioned. Although especially the thickness of a hole-injection layer and an electron hole transportation layer is not limited by the quality of the material, usually the thing of the range of 1nm - 5 micrometers is desirable, and is 5nm - 1 micrometer more preferably, and it is 10nm - 500nm still more preferably. A hole-injection layer and an electron hole transportation layer may be monolayer structures which consist of one sort of the ingredient mentioned above, or two sorts or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0076] as the formation approach of a hole-injection layer and an electron hole transportation layer -- vacuum evaporation technique and LB -- the approaches (a spin coat method, the cast method, dip coating method, etc.) of dissolving or distributing a solvent and coating it with law, the ink jet method, print processes, a replica method, a xerography, said hole-injection

ingredient, and an electron hole transportation ingredient are used. In the case of a coating method, it can dissolve or distribute with a resinous principle, and a polyvinyl chloride, a polycarbonate, polystyrene, polymethylmethacrylate, polyester, polysulfone, polyphenylene oxide, polybutadiene, Pori (N-vinylcarbazole), hydrocarbon resin, ketone resin, phenoxy resin, a polyamide, ethyl cellulose, vinyl acetate, ABS plastics, polyurethane, melamine resin, an unsaturated polyester resin, alkyd resin, an epoxy resin, silicon resin, etc. are mentioned as a resinous principle.

[0077] The ingredient of an electron injection layer and an electronic transportation layer should just have the function to pour in an electron from cathode, the function to convey an electron, or the function that carries out the obstruction of the electron hole which might be poured in from the anode plate. the heterocycle frame which contains two or more hetero atoms as the example, OKISA diazole, and full — me — non, various metal complexes, the above-mentioned derivative, etc. which are represented by the metal complex which makes a ligand ring tetracarboxylic acid anhydrides, such as anthra quinodimethan, an anthrone, a diphenyl quinone, thiopyran dioxide, a carbodiimide, full ORENIRIDEN methane, JISUCHIRIRU pyrazine, and naphthalene perylene, a phthalocyanine, the metal complex of an eight-quinolinol derivative and a metal phthalocyanine, benzo oxazole, and benzothiazole are mentioned. It may be the compound which has atoms other than a carbon atom and a hydrogen atom in [two or more] a basic frame as a heterocycle frame containing two or more hetero atoms as a heterocycle compound containing at least two or more hetero atoms, and you may be a monocycle or a condensed ring. It is the aromatic series heterocycle which has two or more atoms preferably chosen from N, O, and S atom as a heterocycle frame, and has an at least 1N atom in a frame still more preferably, and is the aromatic series heterocycle which has N atom in [two or more] a frame preferably especially. Moreover, a hetero atom may be in a condensation location, or may be in a non-condensation location. For example, a pyrazole, an imidazole, oxazole, a thiazole, triazole, OKISA diazole, thiadiazole, pyrazine, a pyrimidine, indazole, A pudding, phthalazine, a NAFUCHI lysine, quinoxaline, quinoxaline, cinnoline, A pteridine, peri MIJIN, a phenanthroline, a pyrrolo imidazole, Pyrrolo triazole, a pyrazolo imidazole, pyrazolo triazole, A pyrazolo pyrimidine, pyrazolo triazine, an imidazo imidazole, Imidazo pyridazine, an imidazo pyridine, imidazo pyrazine, a triazolo pyridine, Benzimidazole, a naphth imidazole, benzo oxazole, naphth oxazole, benzothiazole, a naphth thiazole, benzotriazol, a TETORAZA indene, triazine, etc. are mentioned. Especially, it is triazole, OKISA diazole, thiadiazole, imidazo pyridazine, an imidazo pyridine, imidazo pyrazine, benzimidazole, a naphth imidazole, benzo oxazole, naphth oxazole, benzothiazole, a naphth thiazole, and triazine preferably, and is an imidazo pyridine, imidazo pyrazine, benzimidazole, and a naphth imidazole more preferably, and they are an imidazo pyridine, benzimidazole, a naphth imidazole, and triazine still more preferably.

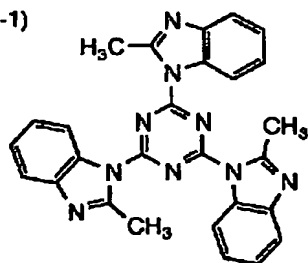
[0078] It is desirable from the point of luminous efficiency to consist of a compound which has T1 level higher than the ingredient which forms a luminous layer preferably especially as an electron injection layer and an electronic transportation layer. Therefore, as for T1 level of the electronic transportation ingredient independent film, it is desirable that it is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 58 kcal/mol (243 kJ/mol). Especially in the case of a blue light emitting device, it is desirable that it is below 82 kcal/mol (344 kJ/mol) more than 64 kcal/mol (268 kJ/mol).

[0079] The following examples are given as a desirable electronic transportation ingredient in this invention.

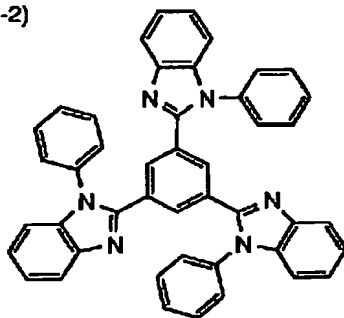
[0080]

[Formula 19]

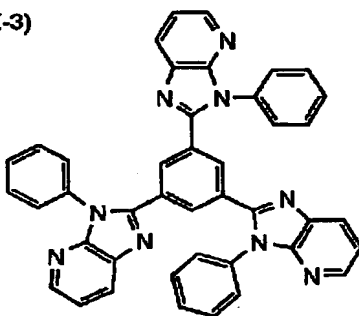
(E-1)



(E-2)



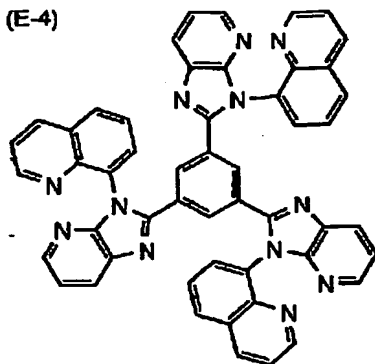
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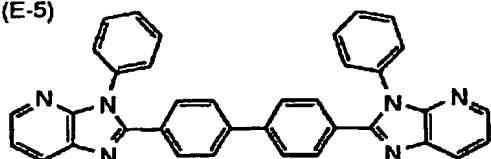
[0081]

[Formula 20]

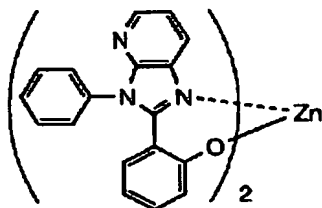
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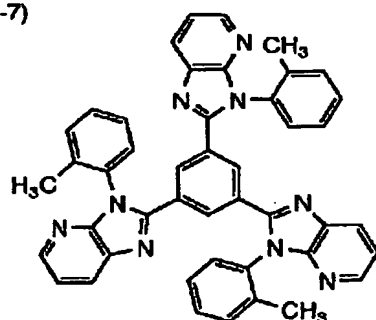
(E-5)



(E-6)



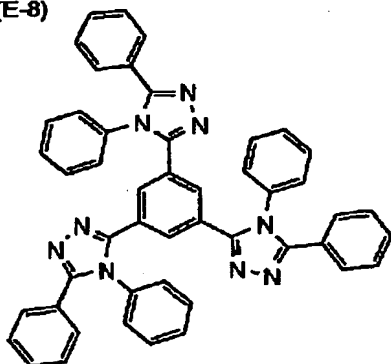
(E-7)



[0082]

[Formula 21]

(E-8)



[0083] Although especially the thickness of an electron injection layer and an electronic transportation layer is not limited, usually the thing of the range of 1nm – 5 micrometers is desirable, and is 5nm – 1 micrometer more preferably, and it is 10nm – 500nm still more preferably. An electron injection layer and an electronic transportation layer may be monolayer

structures which consist of one sort of the ingredient mentioned above, or two or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation. as the formation approach of an electron injection layer and an electronic transportation layer -- vacuum evaporation technique and LB -- the approaches (a spin coat method, the cast method, dip coating method, etc.) of dissolving or distributing a solvent and coating it with law, the ink jet method, print processes, a replica method, a xerography, said electron injection ingredient, and an electronic transportation ingredient are used. In the case of a coating method, it can dissolve or distribute with a resinous principle, and what was illustrated as a resinous principle in the case of for example, the hole injection and the transportation layer can be applied.

[0084] In the light emitting device of this invention, a protective layer may be prepared in the maximum front face. What is necessary is just to have the function which inhibits that what promotes component degradation of moisture, oxygen, etc. as an ingredient of a protective layer enters in a component. As the example, In, Sn, Pb, Au, Cu, Ag, aluminum, Metals, such as Ti and nickel, MgO, SiO and SiO₂, aluminum₂O₃, GeO, Metallic oxides, such as NiO, CaO, BaO, Fe₂O₃, Y₂O₃, and TiO₂, Metal fluorides, such as nitrides, such as SiN_x and SiN_xO_y, and MgF₂, LiF, AlF₃, CaF₂, Polyethylene, polypropylene, polymethylmethacrylate, polyimide, Poly urea, polytetrafluoroethylene, polychlorotrifluoroethylene resin, The copolymer of poly dichlorodifluoroethene, chlorotrifluoroethylene, and dichlorodifluoroethene, The copolymer which is made to carry out copolymerization of the monomer mixture containing at least one sort of comonomers to tetrafluoroethylene, and is obtained, the fluorine-containing copolymer which has cyclic structure in a copolymerization principal chain, the absorptivity matter of 1% or more of water absorption, the dampproof matter of 0.1% or less of water absorption, etc. are mentioned.

[0085] the formation approach of a protective layer -- especially -- limitation -- there is nothing -- for example, a vacuum deposition method, the sputtering method, a reactive sputtering method, and MBE (molecular beam epitaxy) -- law, the ionized cluster beam method, the ion plating method, a plasma polymerization method (the high-frequency excitation ion plating method), a plasma-CVD method, a laser CVD method, a heat CVD method, a gas source CVD method, a coating method, the ink jet method, print processes, a replica method, and a xerography are applicable.

[0086]

[Example] Although an example is given to below and this invention is concretely explained to it, thereby, this invention is not limited.

What produced ITO by the thickness of 150nm on the example 125mmx25mmx0.7mm glass substrate (Tokyo Sanyo Vacuum Co., Ltd. make) was used as the transparence support substrate. The spin coat was carried out on the substrate which washed BaytronP (a PEDOT-PSS water distribution object (polyethylene dioxythiophene-polystyrene sulfonate dope object) / Bayer make) as a conductive ingredient which forms an adjacent layer for this transparence support substrate after etching and washing (1000rpm, 30 seconds), and the vacuum drying was carried out at 150 degrees C for 1.5 hours. The thickness of an adjacent layer was 50nm. This substrate was put into vacuum evaporatio equipment, vapor codeposition was carried out so that thickness might serve as an evaporation rate of 0.04nm/second in the vacuum of 10⁻³ to ten to 4 Pa and might be served as [ingredient / (H-1) / luminescent material (D-1) and / host] to 36nm in 0.4nm/[in a second] next under the condition of a substrate temperature room temperature, respectively, and the luminous layer was formed. After having vapor-deposited 36nm (E-1) of electronic transportation ingredients furthermore, equipping with the mask (luminescence area is set to 4mmx5mm) which carried out patterning on the organic thin film and vapor-depositing 5nm of lithium fluoride, 50nm was vapor-deposited for aluminum, the component was closed succeedingly, and the EL element was produced (component No.101).

[0087] Baytron of example 2 example 1 The substrate which carried out the spin coat of TPDPES-TBPA which is similarly a conductive ingredient instead of P was put into vacuum evaporatio equipment, and the same component as an example 1 was produced (component No.102).

[0088] 10nm was vapor-deposited instead of the electronic transportation ingredient (E-1) of

example 3 example 2, Alq3 [30nm] was vapor-deposited for BCP on it, 10nm fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.103).

[0089] Ir(ppy) 3 was used instead of the luminescent material (D-1) of example 4 example 3, and the component using CBP as a host ingredient was produced (component No.104).

[0090] The substrate which carried out the spin coat of TPDPES-TBPA like example of comparison 1 example 2 was put into vacuum evaporationno equipment, and 50nm of NPD(s) was vapor-deposited under the condition of a substrate temperature room temperature in the vacuum of 10⁻³ to ten to 4 Pa. Next, vapor codeposition of luminescent material Ir(ppy) 3 and the host ingredient (CBP) was carried out so that thickness might be set to 36nm in a second in the evaporation rate of 0.04nm/second, and 0.4nm /, respectively, and the luminous layer was formed. Furthermore, Alq3 [30nm] was vapor-deposited for BCP 10nm and on it, lithium fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.105).

[0091] The luminescent material of the example 1 of example of comparison 2 comparison was changed into (D-1), and the same component was produced (component No.106).

[0092] The host ingredient of the example 2 of example of comparison 3 comparison was changed into (H-1), and the same component was produced (component No.107).

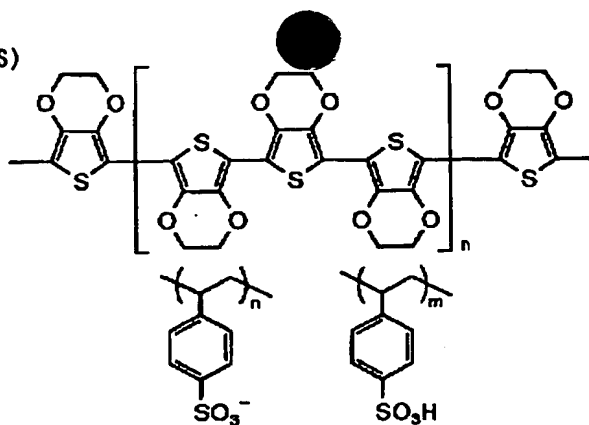
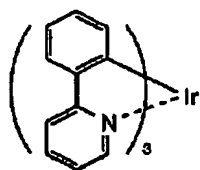
[0093] The spin coat of what dissolved Pori (N-vinylcarbazole) 40mg and Ir(ppy)34mg in dichloroethane 2.5ml was carried out on the substrate which carried out the spin coat of PEDOT-PSS like example of comparison 4 example 1. The total thickness of an organic layer was 80nm. This substrate was put into vacuum evaporationno equipment, in the vacuum of 10⁻³ to ten to 4 Pa, 30nm and 20nm of Alq(s) were vapor-deposited for TAZ next under the condition of a substrate temperature room temperature, lithium fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.108).

[0094] The structure of the compound used for below by this invention is shown.

[0095]

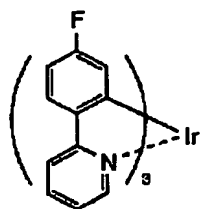
[Formula 22]

(PEDOT-PSS)

(Ir(ppy)₃)

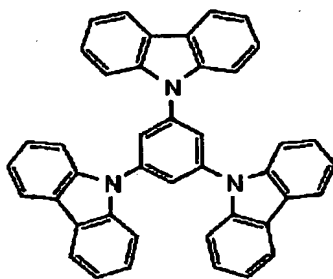
T₁レベル
60kcal/mol
(252kJ/mol)
燐光の量子収率
 $\phi_{ph}=0.70$

(D-1)



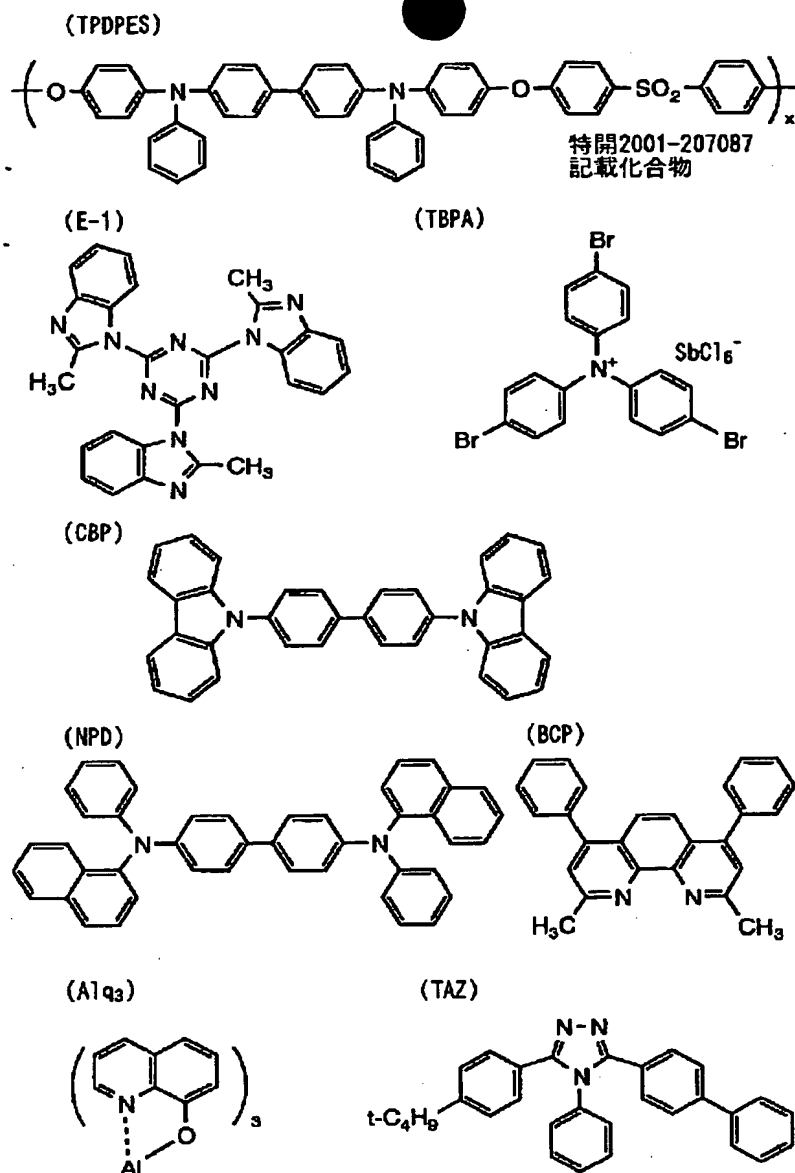
T₁レベル
63kcal/mol
(264kJ/mol)
燐光の量子収率
 $\phi_{ph}=0.91$

(H-1)



[0096]

[Formula 23]



[0097] Next, each component which is the following, and was made and produced was evaluated. An evaluation result is shown in Table 1. direct-current constant current is impressed to an organic thin film by using aluminum as cathode using the TOYO source major unit 2400, using ITO as an anode plate, and light is emitted in the component of the example of a comparison, and this invention -- making -- the brightness -- luminance-meter BM-8 of TOPCON CORP., and luminescence wavelength -- the Hamamatsu Photonics make -- it measured using spectrum analyzer PMA-11 and luminous efficiency was searched for. Moreover, the constant current drive of the component was carried out by initial brightness 100 cd/m², and brightness half line was measured. Moreover, when the minimum excitation triplet energy level of the film of the luminous layer excluding luminescent material from the luminous layer was measured, CBP was 62 kcal/mol (260 kJ/mol) and H-1 was 65 kcal/mol (272 kJ/mol).

[0098]

[Table 1]

素子 No.	ELmax	色度(x,y)	外部量子 効率	駆動電圧 (5000cd/m ²)	備考
101	488nm	(0.15,0.52)	22%	10.0V	本発明
102	486nm	(0.17,0.49)	20%	10.2V	本発明
103	484nm	(0.16,0.52)	15%	10.5V	本発明
104	517nm	(0.31,0.61)	17%	10.4V	本発明
105	516nm	(0.31,0.61)	16%	12.0V	比較例
106	485nm	(0.17,0.49)	4%	15.0V	比較例
107	485nm	(0.17,0.49)	5%	14.1V	比較例
108	514nm	(0.31,0.60)	2%	12.3V	比較例

[0099] Here, a chromaticity shows the value of the chromaticity coordinate (x y) defined by the CIE color system.

[0100] The component which produced the luminous layer by vacuum evaporation compared with the component (component No.108) which produced the luminous layer by spreading so that clearly from the result of Table 1 is excellent in luminous efficiency. And although luminous efficiency fell greatly when the luminescent material of an efficient green light emitting device (component No.105) was changed into the short wave luminescent material (D-1) of blue luminescence (106 component No. 107), by making a conductive ingredient layer adjoin a luminous layer, and using the host ingredient which has the high minimum excitation triplet energy level shows that efficient luminescence can be carried out (component No.101-103). Moreover, if driver voltage in case the luminescence brightness of a component is 5000 cd/m² is compared, this invention component is about about 10v, and a low-battery drive is possible for it compared with a comparison component. When the efficient light emitting device of this invention compares the brightness maintenance factor after excelling also in endurance and performing a constant voltage drive for 30 minutes by initial brightness 5000 cd/m², it is a 107= 11 times as many 101/component of components as this, and a 105= 2 twice as many 104/component of components as this, and the component of this invention is excellent in the endurance at the time of high brightness luminescence. Compared with the example component of a comparison, destruction of a component does not take place under the high voltage and a high current, but high brightness luminescence is still more possible for the component of this invention.

[0101]

[Effect of the Invention] By this invention, a luminous layer is formed of vacuum deposition and the light emitting device which a low-battery drive is possible and carries out efficient luminescence of the specific conductivity (an ingredient and physical properties) since it has an adjacent layer can be obtained. In especially a triplet blue light emitting device, efficient luminescence is possible.

[Translation done.]

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3. In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to organic electroluminescence devices available in fields, such as a back light, a flat-panel display, the source of the illumination light, a display device, electrophotography, organic-semiconductor laser, the record light source, the exposure light source, the reading light source, an indicator, a signboard, and an optical-communication device.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] Although researches and developments of various light emitting devices are done actively today, in it, the organic electroluminescence (EL) component has the features, such as super-thin shape and lightweight nature, high-speed responsibility, extensive angle-of-visibility nature, and a low-battery drive, and attracts attention as a promising light emitting device. Generally, the organic EL device consists of counterelectrodes of the pair the luminous layer and this whose layer were pinched, and the electron poured in from cathode and the electron hole poured in from the anode plate recombine it, and it uses luminescence from the generated exciton.

[0003] What has the laminated structure shown by Tang and others as an organic EL device which emits light in high brightness by current and the low battery is known (nonpatent literature 1 reference). When this component carries out the laminating of the ingredient which served both as an electronic transportation ingredient and luminescent material, and the hole transportation ingredient, green luminescence of high brightness has been obtained, it is the direct current voltage of 6-7V, and brightness has reached thousands cd/m². However, when a practical component is considered, development of the further high brightness and an efficient light emitting device is desired. The light emitting device which used the alt.metal-ized complex (Ir(ppy)₃:tris-ortho-iridated complex with 2-Phenylpyridine) of iridium as a luminescent material was reported as a component which can emit light recently still more efficient (nonpatent literature 2 reference). This light emitting device uses phosphorescence luminescence from a triplet exciton, that external quantum efficiency (luminous efficiency) is 8.3%, and exceeds 5% of external quantum efficiency called limitation conventionally, and it excels. Usually, the ratio of the singlet exciton which contributes to firefly luminescence, and the triplet exciton which contributes to phosphorescence luminescence is 1:3, and can improve luminous efficiency by using a triplet exciton. However, since it is limited to the green light emitting device, the alt.metal-ized complex of said iridium needs development of the component which emits light efficient also about other colors, especially blue, when applying to a full color display or a white light emitting device.

[0004] In the light emitting device using a triplet exciton like the alt.metal-ized complex of the above-mentioned iridium, if the minimum excitation triplet energy level of the host ingredient in a luminous layer is lower than luminescent material, since the luminous efficiency of a component will fall, the minimum excitation triplet energy level of a host ingredient must be made higher than that of luminescent material. When [the light emitting device which uses a triplet exciton especially excelled / when / in color purity] carrying out blue luminescence, the emission spectrum of luminescent material becomes short wave, that is, the minimum excitation triplet energy level of this luminescent material becomes high. And the minimum excitation triplet energy level of luminescent material needs to follow on becoming high, and also needs to make high the minimum excitation triplet energy level of a host ingredient. If the minimum excitation triplet energy level of a host ingredient becomes high, charge impregnation nature will fall, and if it is going to maintain charge impregnation nature, driver voltage becomes high and may drop the endurance of a component. Therefore, in order to attain efficient luminescence in the light emitting device using a triplet exciton, development of the approach of pouring a charge into a

host ingredient efficiently was desired. Moreover, it was thought that the minimum excitation triplet energy level of the layer which a luminous layer adjoins is also important for efficient luminescence, when the minimum excitation triplet energy level of the adjoining layer is lower than the minimum excitation triplet energy level of luminescent material, the triplet exciton generated in the host ingredient did not carry out energy transfer to luminescent material, but energy transfer carried out to the adjoining layer, and development of a component for which the layer which luminous efficiency may fall and adjoins does not bar the energy transfer to luminescent material was desired. Furthermore, development of the component excellent in the endurance at the time of high brightness luminescence was desired.

[0005]

[Nonpatent literature 1] Applied Physics Letters (Applied Physics Letters), 1987, 51 volumes, 913 pages [Nonpatent literature 2] Applied Physics Letters (Applied Physics Letters), 1999, 75 volumes, 4 pages

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3. In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] By this invention, a luminous layer is formed of vacuum deposition and the light emitting device which a low-battery drive is possible and carries out efficient luminescence of the specific conductivity (an ingredient and physical properties) since it has an adjacent layer can be obtained. In especially a triplet blue light emitting device, efficient luminescence is possible.

[Translation done.]

JAPANESE

[JP,2003-257676,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] this invention persons found out that efficient blue luminescence was realizable by making a conductive polymer adjoin a vacuum evaporatio no mold luminous layer, as a result of examining wholeheartedly the technique of carrying out efficient luminescence of the triplet blue light emitting device. That is, the above-mentioned technical problem is attained by the following means.

(1) They are the organic electroluminescence devices which have the luminous layer formed of vacuum evaporatio no between an anode plate and cathode, a luminous layer contains at least one sort of luminescent material which emits light from a triplet excitation state, have the adjacent layer which adjoins at least one side by the side of the anode plate of a luminous layer, and cathode, and are characterized by an adjacent layer containing a conductive polymer.

[0008] (2) Organic electroluminescence devices given in the above (1) to which the minimum excitation triplet energy level of luminescent material considers that it is [63 or more kcal/mol] 81 or less kcal/mol as the description.

(3) The above (1) characterized by the quantum yield of the phosphorescence of luminescent material being 0.5 or more, or organic electroluminescence devices given in (2).

(4) Organic electroluminescence devices given in either of above-mentioned (1) - (3) to which the minimum excitation triplet energy level of the luminous layer except luminescent material is characterized by 64 or more kcal/mol being 82 or less kcal/mol.

[0009] (5) Organic electroluminescence devices given in either of above-mentioned (1) - (4) characterized by the electrical conductivity of an adjacent layer being -one or more 10^{-6} S-cm.

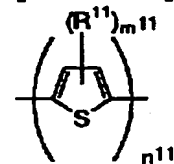
(6) Organic electroluminescence devices given in either of above-mentioned (1) - (5) characterized by a conductive polymer being the disconjugation macromolecule or conjugation macromolecule which connected the terrorism ring with an aromatic series ring or aromatic series by the connection radical more than bivalence.

(7) Organic electroluminescence devices given in either of above-mentioned (1) - (6) characterized by being the conjugation macromolecule with which the conductive polymer had the dopant doped.

(8) Organic electroluminescence devices given in either of above-mentioned (1) - (7) characterized by a conductive polymer having the substructure expressed with the following general formula (I). General formula (I)

[0010]

[Formula 4]

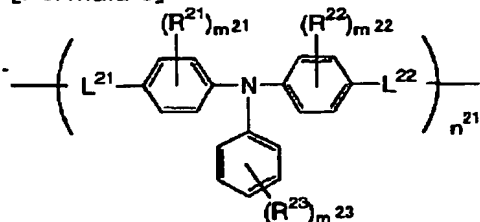


[0011] R11 expresses a substituent among a formula and m11 expresses the integer of 0 thru/or 2. When m11 expresses 2, two or more R11 may be mutually the same, or may differ, may be connected mutually, and may form a ring. n11 expresses one or more integers.

[0012] (9) Organic electroluminescence devices given in either of above-mentioned (1) – (6) characterized by a conductive polymer having the substructure expressed with the following general formula (II). General formula (II)

[0013]

[Formula 5]

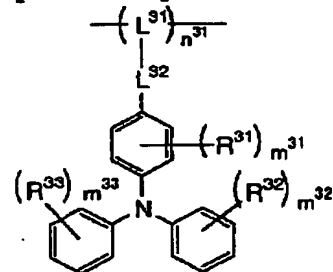


[0014] L21 and L22 express a divalent connection radical among a formula. R21, R22, and R23 express a substituent, m21 and m22 express the integer of 0 thru/or 4, and m23 expresses the integer of 0 thru/or 5. When m21 and m22 express the integer of 2 thru/or 4 and m23 expresses the integer of 2 thru/or 5, two or more R21, R22, and R23 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n21 expresses one or more integers.

[0015] (10) Organic electroluminescence devices given in either of above-mentioned (1) – (6) characterized by a conductive polymer having the substructure expressed with the following general formula (III). General formula (III)

[0016]

[Formula 6]



[0017] A connection radical trivalent in L31 and L32 express single bond or a divalent connection radical among a formula. R31, R32, and R33 express a substituent, m31 expresses the integer of 0 thru/or 4, and m32 and m33 express the integer of 0 thru/or 5. When m31 expresses the integer of 2 thru/or 4 and m32 and m33 express the integer of 2 thru/or 5, two or more R31, R32, and R33 may be mutually the same respectively, or may differ from each other, may be connected mutually, and they may form a ring. n31 expresses one or more integers.

[0018]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. The organic electroluminescence devices of this invention are organic electroluminescence devices which have the luminous layer of at least one layer in inter-electrode [of a pair], and it is characterized by for the adjacent layer of a luminous layer containing a conductive polymer, and containing at least one sort of luminescent material which a luminous layer is produced by vacuum deposition and emits light from a triplet excitation state. Although it can have an adjacent layer in both by the side of an anode plate or cathode to a luminous layer, having in an anode plate side is desirable. In this case, the minimum lamination of organic electroluminescence devices is an anode plate / adjacent layer / luminous layer / cathode (/ interface). The function and property for which it asks respond and you may have a hole impregnation layer, a hole transportation layer, an electron injection layer, an electronic transportation layer, a protective layer, etc. also in except, and these each class may be equipped with other functions, respectively, and an adjacent layer may be equipped with the function of these each class.

[0019] As for the electrical conductivity (unit: S-cm⁻¹) of an adjacent layer, it is desirable to consider as one or more 10⁻⁶ S-cm, its one or more 10⁻³ S-cm is more desirable, and especially its one or more 10⁻¹ S-cm is desirable. The charge impregnation transportability to a luminous layer can go up, and luminous efficiency can be raised, so that the electrical conductivity of an adjacent layer is high. Moreover, there is effectiveness also in stopping the driver voltage of a component. By this invention, by preparing an adjacent layer, since level arises between an electrode and a luminous layer, the charge impregnation to a luminous layer becomes easy to be performed. Level puts ionization potential or an electron affinity here.

[0020] The conductive polymer contained in an adjacent layer by this invention is the disconjugation macromolecule or conjugation macromolecule which connected an aromatic series ring or aromatic series heterocycle by the connection radical more than single bond or bivalence preferably. Here, as an aromatic series ring, the benzene ring is mentioned, for example and a condensed ring may be formed further. Moreover, as aromatic series heterocycle, for example, a pyridine ring, a villa gin ring, a pyrimidine ring, a pyridazine ring, a triazine ring, an oxazole ring, a thiazole ring, an imidazole ring, an oxadiazole ring, a thiadiazole ring, a triazole ring, a tetrazole ring, a furan ring, a thiophene ring, a pyrrole ring, the Indore ring, a carbazole ring, a PENZO imidazole ring, an imidazo pyridine ring, etc. may be mentioned, a condensed ring may be formed further, and you may have a substituent. Moreover, as a connection radical more than the bivalence which connects an aromatic series ring or aromatic series heterocycle, the connection radical formed with single bond, a carbon atom, a silicon atom, a nitrogen atom, a boron atom, an oxygen atom, a sulfur atom, a metal, a metal ion, etc. is mentioned. It is the radical preferably formed from single bond, a carbon atom, a nitrogen atom, a silicon atom, a boron atom, an oxygen atom, sulfur atoms, and such combination, and the methylene group which is not permuted [a permutation or], a carbonyl group, an imino group, a sulfonyl group, a sulfinyl group, an ester group, an amide group, a silyl radical, etc. are mentioned as a radical formed of combination.

[0021] It is still more desirable that it is a conjugation macromolecule from a viewpoint which improves charge impregnation nature to a luminous layer, and gathers luminous efficiency as a conductive polymer. As an example of a conjugation giant molecule, polyacetylene, the poly diacetylene, Pori (PARAFENIREN), The poly fluorene, the poly azulene, Pori (PARAFENIRENSARUFAIDO), Polypyrrole, the poly thiophene, PORISO thianaphthene, the poly aniline, Pori (PARAFENIREMBINIREN), Pori (2, 5-thienylene vinylene), A double chain type conjugated-system macromolecule, a metal phthalocyanines (poly peri naphthalene etc.) system macromolecule, and other conjugated-system macromolecules (Pori (PARAKI silylene), Pori [alpha-(5 and 5'-bithiophene diyl) benzylidene], etc.) are mentioned. They are Pori (PARAFENIREN), polypyrrole, the poly thiophene, the poly aniline, Pori (PARAFENIREMBINIREN), and Pori (2 and 5-thienylene vinylene is mentioned and Pori (PARAFENIREN), the poly thiophene, Pori (PARAFENIREMBINIREN), etc. are mentioned more preferably.) preferably. It is the conductive polymer which has especially the substructure expressed with the above-mentioned general formula (I) preferably as a conjugated-system macromolecule. R11 expresses a substituent among the above-mentioned general formula (I), and m11 expresses the integer of 0 thru/or 2. When m11 expresses 2, two or more R11 may be mutually the same, or may differ, may be connected mutually, and may form a ring.

[0022] as the substituent which R11 expresses -- an alkyl group (they are carbon numbers 1-8 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-12 --) for example, methyl, ethyl, iso-propyl, tert-butyl, n-octyl, n-DESHIRU, n-hexadecyl, cyclo propyl, cyclopentyl, cyclohexyl, etc. are mentioned. an alkenyl radical (they are carbon numbers 2-8 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-12 --) for example, vinyl, an allyl compound, 2-butenyl, 3-pentenyl, 2-hexenyl, 3-hexenyl, 4-hexenyl, 2-OKUTENIRU, etc. are mentioned. an alkynyl group (especially, it is carbon numbers 2-8 preferably, for example, propargyl, 3-cutting-pliers nil, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-12 --) an aryl group (they are carbon numbers 6-12 especially preferably desirable -- carbon numbers 6-30 -- more -- desirable -- carbon numbers 6-20 --) for example, phenyl, p-methylphenyl, naphthyl,

etc. are mentioned. the amino group (especially, it is carbon numbers 0-6 preferably, for example, amino, methylamino, dimethylamino, diethylamino, dibenzylamino, diphenylamino, etc. are mentioned. desirable -- carbon numbers 0-20 -- more -- desirable -- carbon numbers 0-10 --) ** [0023] an alkoxy group (they are carbon numbers 1-8 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-12 --) for example, methoxy, ethoxy ** butoxy, hexyloxy one, octyloxy, etc. are mentioned. an aryloxy group (especially, it is carbon numbers 6-12 preferably, for example, phenyloxy, 2-naphthyloxy, etc. are mentioned. desirable -- carbon numbers 6-20 -- more -- desirable -- carbon numbers 6-16 --) an acyl group (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, acetyl, benzoyl, the formyl, pivaloyl, etc. are mentioned. an alkoxy carbonyl group (especially, it is carbon numbers 2-12 preferably, for example, methoxycarbonyl, ethoxycarbonyl, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) an aryloxy carbonyl group (desirable -- carbon numbers 7-20 -- more -- desirable -- carbon numbers 7-16 -- especially, it is carbon numbers 7-10 preferably, for example, phenyloxy carbonyl etc. is mentioned.), [0024] an acyloxy radical (they are carbon numbers 2-10 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) for example, acetoxyl, benzoyloxyl one, etc. are mentioned. the acylamino radical (especially, it is carbon numbers 2-10 preferably, for example, acetylamino, benzoylamino, etc. are mentioned. desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) an alkoxycarbonylamino radical (they are carbon numbers 2-12 especially preferably desirable -- carbon numbers 2-20 -- more -- desirable -- carbon numbers 2-16 --) for example, methoxycarbonylamino etc. is mentioned. an aryloxycarbonylamine radical (especially, it is carbon numbers 7-12 preferably, for example, phenyloxy carbonylamino etc. is mentioned. desirable -- carbon numbers 7-20 -- more -- desirable -- carbon numbers 7-16 --) a sulfonylamino radical (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, methanesulfonylamino, benzenesulfonyl amino, etc. are mentioned. a sulfamoyl group (especially, it is carbon numbers 0-12 preferably, for example, sulfamoyl, methyl sulfamoyl, dimethyl sulfamoyl, phenyl sulfamoyl, etc. are mentioned. desirable -- carbon numbers 0-20 -- more -- desirable -- carbon numbers 0-16 --) ** [0025] a carbamoyl group (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, carbamoyl, methyl carbamoyl, diethylcarbamoyl, phenylcarbamoyl, etc. are mentioned. an alkylthio group (especially, it is carbon numbers 1-12 preferably, for example, a methylthio, ethyl thio, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) an aryl thio radical (they are carbon numbers 6-12 especially preferably desirable -- carbon numbers 6-20 -- more -- desirable -- carbon numbers 6-16 --) for example, phenylthio etc. is mentioned. a sulfonyl group (especially, it is carbon numbers 1-12 preferably, for example, mesyl, tosyl, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) a sulfinyl group (especially, it is carbon numbers 1-12 preferably, for example, methane sulfinyl, benzene sulfinyl, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) an ureido radical (they are carbon numbers 1-12 especially preferably desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) for example, ureido, methyl ureido, phenyl ureido, etc. are mentioned. a phosphoric-acid amide group (especially, it is carbon numbers 1-12 preferably, for example, a diethyl phosphoric-acid amide, a phenyl phosphoric-acid amide, etc. are mentioned. desirable -- carbon numbers 1-20 -- more -- desirable -- carbon numbers 1-16 --) ** [0026] a hydroxy group, a sulfhydryl group, a halogen atom (for example, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom), a cyano group, a sulfonic group, a carboxyl group, a nitro group, a hydroxamic acid radical, a SURUFINO radical, a hydrazino radical, an imino group, and a heterocycle radical (desirable -- carbon numbers 1-20 -- it is carbon numbers 1-12 more preferably, and a nitrogen atom, an oxygen atom, and a sulfur atom are mentioned as a hetero atom, for example.) Specifically For example, a pyrrolidine, a piperidine, a piperazine, morpholine, A thiophene, a furan, a pyrrole, an imidazole, a pyrazole, a pyridine, Pyrazine, pyridazine, triazole, triazine, Indore, indazole, A pudding, thiazoline,

a thiazole, thiadiazole, oxazoline, Oxazole, OKISA diazole, a quinoline, an is...dinoline, phthalazine, a NAFUCHI lysine, quinoxaline, quinazoline, cinnoline, a pteridine, an acridine, a phenanthroline, phenazine, tetrazole, benzimidazole benzoxazole, a bends thiazole, benzotriazol, a TETORAZA indene, etc. are mentioned. a silyl radical (desirable -- carbon numbers 3-40 -- more -- desirable -- 3-30 -- especially, it is 3-24 preferably, for example, trimethylsilyl, triphenyl silyl, etc. are mentioned.) etc. is mentioned.

[0027] The above-mentioned substituent may be permuted further. moreover, when it has two or more substituents, even if those substituents are mutually the same, they may differ, and when possible, it may connect, and a ring may be formed. As a ring formed, the benzene ring, a thiophene ring, a dioxane ring, a dithiane ring, etc. are mentioned.

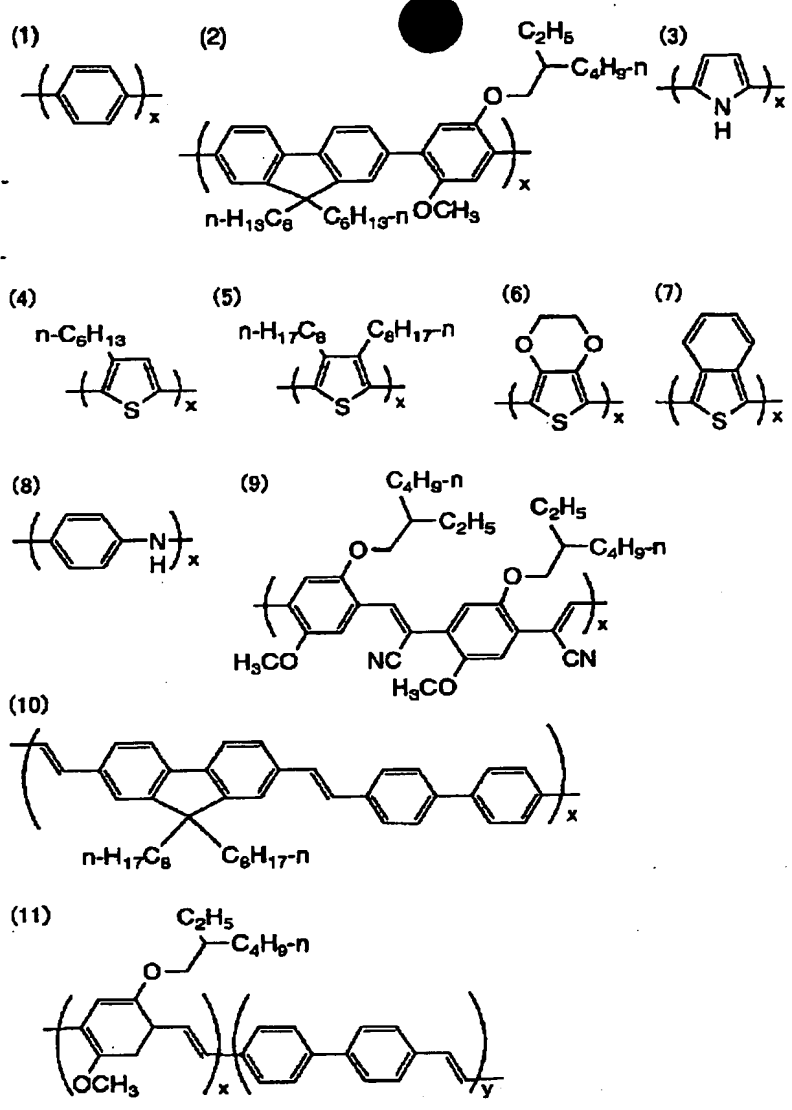
[0028] As a substituent which R11 expresses, it is an alkyl group, an alkenyl radical, an alkynyl group, an alkoxy group, and an alkylthio group preferably, and they are an alkyl group, an alkoxy group, and an alkylthio group still more preferably. Especially, preferably, when m11 is 2, it is the alkoxy group and alkylthio group in which two R11 formed the ring, for example, a dioxane ring, a dithiane ring, etc. are mentioned. R11 is an alkyl group when m11 is 1 (the alkyl group of carbon numbers 2-8 is desirable). moreover, the stereo which connected all the connection formats with the adjacent thiophene ring by 2-5' when R11 was Pori (3-alkyl thiophene) which is an alkyl group -- although there are a regular thing and what [solid irregularity-/ a thing] in which 2-2' and 5-5' connection are included, a three-dimensional irregular thing is desirable.

[0029] the inside of the above-mentioned general formula (I), and n11 -- desirable -- 10-10000 -- more -- desirable -- 50-5000 -- it is the integer of 50-1000 especially preferably.

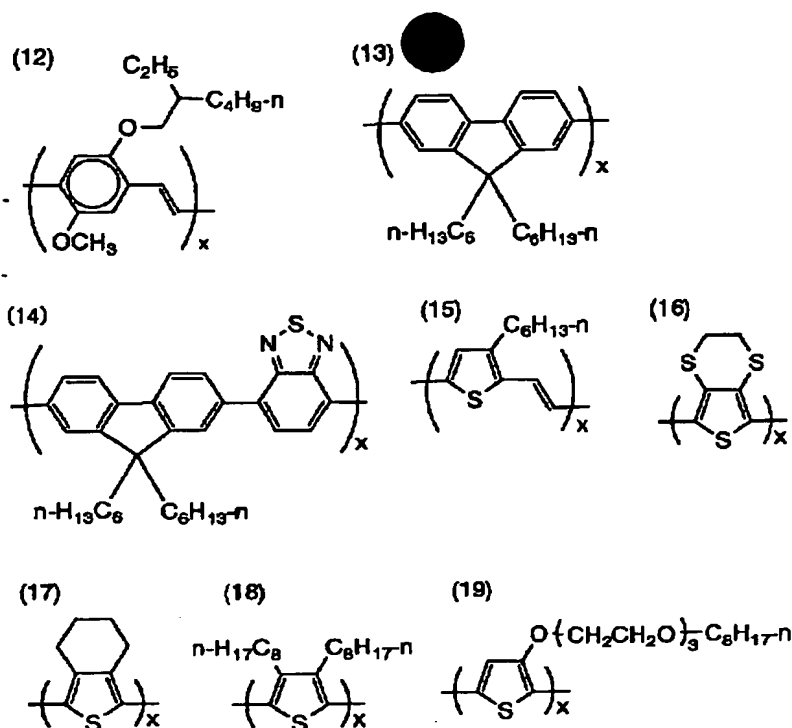
[0030] Although the example of a conjugated-system macromolecule is shown below, this invention is not limited to these. Moreover, the compound of WO98/01909 publication etc. is mentioned other than these.

[0031]

[Formula 7]



[0032]
[Formula 8]



[0033] The conductive polymer which has the substructure expressed with the above-mentioned general formula (II) or the above-mentioned general formula (III) as a disconnection macromolecule is desirable. R21, R22, R23, R31, R32, and R33 express a substituent among the above-mentioned general formula (II) or the above-mentioned general formula (III), and this substituent is synonymous with R11 in the above-mentioned general formula (I). m21, m22, and m31 express the integer of 0 thru/or 4, and m23, m32, and m33 are the integers of 0 thru/or 5. When m21 expresses two or more integers, two or more R21 may be mutually the same, or may differ, may be connected mutually, and may form a ring (the same is said of two or more R22, R23, R31, R32, and R33 which exist when m22, m23, m31, m32, and m33 express two or more integers). The ring to form is an aromatic series ring or ring heterocycle preferably. It is a connection radical divalent in L21, L22, and L32, and a connection radical trivalent in L31, and is the radical formed from an aromatic series ring, aromatic series heterocycle, a carbon atom, a nitrogen atom, a silicon atom, a boron atom, an oxygen atom and sulfur atoms, or such combination, and the methylene group which is not permuted [a permutation or, an aromatic series ring radical, a carbonyl group, an imino group, a sulfonyl group, a sulfinyl group an ester group, an amide group, etc. be mentioned as a radical formed from combination.

[0034] In a general formula (II), R21, R22, and R23 are an alkyl group, an alkoxy group, and an aryl group preferably, and are an alkyl group and an aryl group more preferably. When m21, m22, and m23 express two or more integers, two or more R21, R22, and R23 may be connected mutually, respectively, and they may form a ring, the ring formed is desirable and an aromatic series ring, aromatic series heterocycle, etc. are mentioned. R23 is an aromatic series ring which has a diaryl amino group as a substituent preferably especially. L21 and L22 are radicals which consist of the methylene group which is not permuted [a permutation or], a carbonyl group, a sulfonyl group, a sulfinyl group, an ester group, an aromatic series ring, silyl radicals, or such combination preferably.

[0035] In a general formula (III), R31, R32, and R33 are an alkyl group, an alkoxy group, and an aryl group preferably, and are an alkyl group and an aryl group more preferably. When m31, m32, and m33 express two or more integers, two or more R31, R32, and R33 may be connected mutually, respectively, and they may form a ring, the ring formed is desirable and an aromatic series ring, aromatic series heterocycle, etc. are mentioned. R33 is an aromatic series ring which has a diaryl amino group as a substituent preferably especially. L21 and L22 are radicals which consist of the methylene group which is not permuted [a permutation or], a carbonyl group, a

sulfonyl group, a sulfinyl group, an ester group, an aromatic series ring, silyl radicals, or such combination preferably.

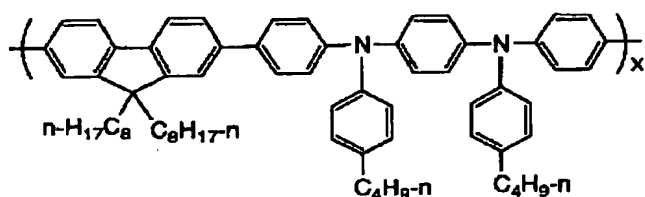
[0036] n21 and n31 — desirable — 5-5000 — more — desirable — 20-2000 — it is the integer of 20-1000 especially preferably.

[0037] Although the example of a non-conjugated-system macromolecule is shown below, this invention is not limited to these. Moreover, the compound of a publication etc. is mentioned to patent No. 310989, JP,7-188398,A, JP,8-188773,A, JP,8-269446,A, JP,8-295880,A, JP,2000-80167,A, JP,2000-150169,A, JP,2001-208087,A, JP,2002-75654,A, JP,2002-117982,A, JP,2002-117983,A, the ** table No. 506481 [2002 to], etc. also at everything but these.

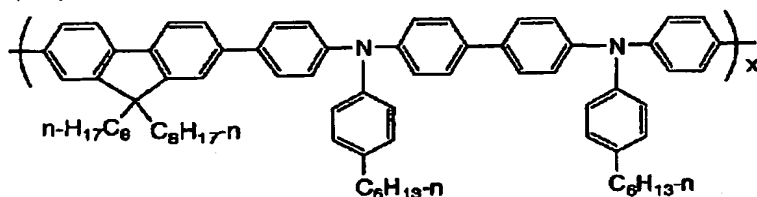
[0038]

[Formula 9]

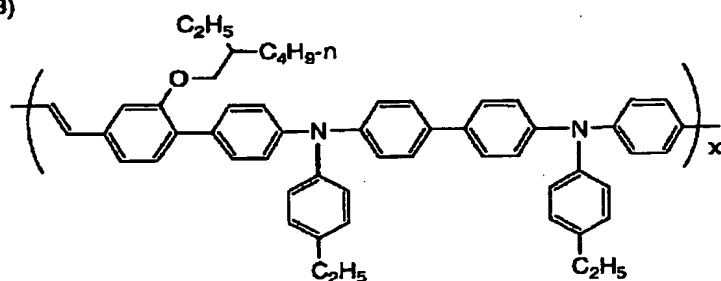
(A-1)



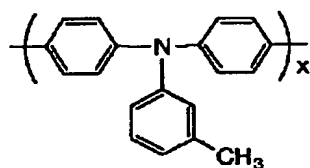
(A-2)



(A-3)



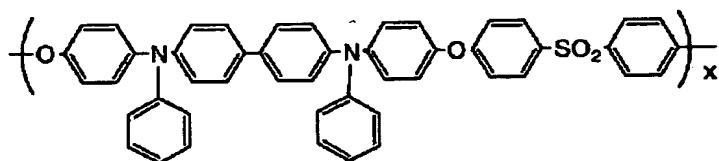
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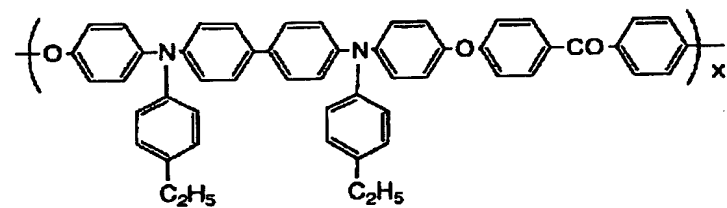
[0039]

[Formula 10]

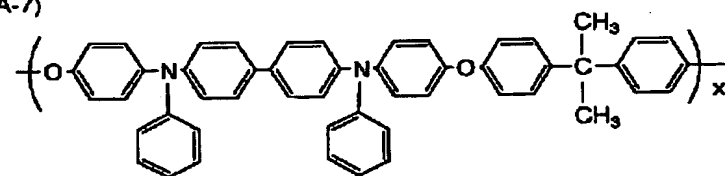
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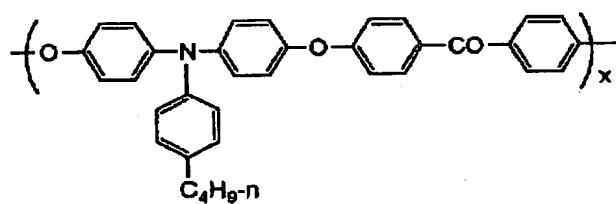
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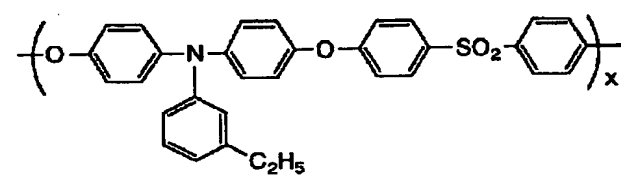
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(A-8)



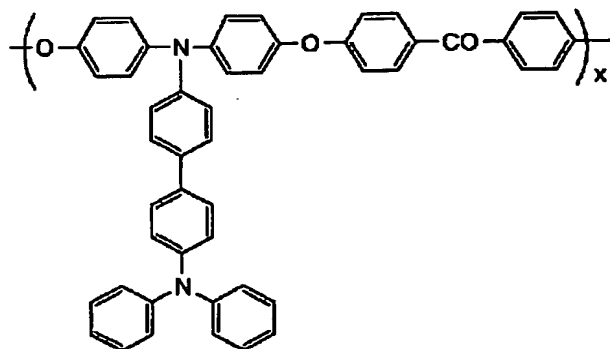
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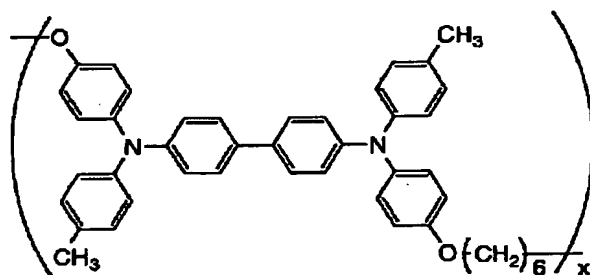
[0040]

[Formula 11]

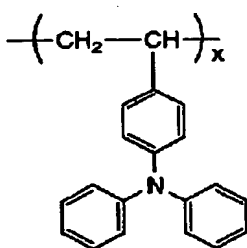
(A-10)



(A-11)



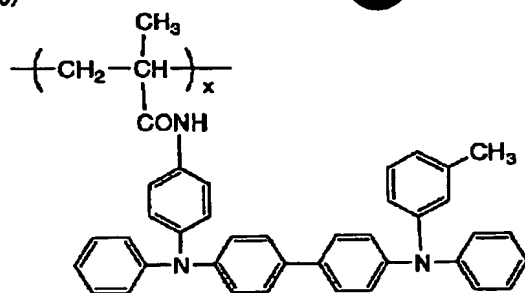
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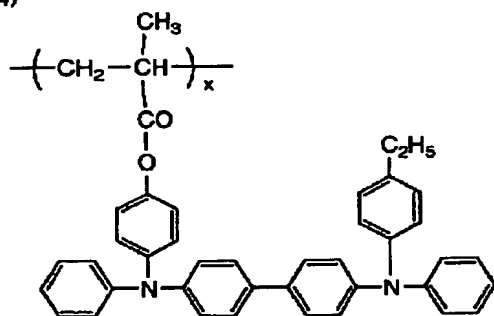
[0041]

[Formula 12]

(A-13)



(A-14)



[0042] 1000-1 million are desirable, and are 10000-500000 more preferably, and the weight average molecular weight of the conductive polymer used by this invention is 10000-100000 still more preferably.

[0043] As for the viewpoint which raises the electrical conductivity of an adjacent layer, improves the charge impregnation nature to a luminous layer further, and gathers luminous efficiency to a conductive polymer, it is desirable to contain a kind of dopant at least, and it is more desirable to make said conjugation macromolecule contain a dopant. As a dopant contained in a conductive polymer, an electronic receptiveness (acceptor) dopant and an electron-donative (donor) dopant are mentioned.

[0044] As an example of an electronic receptiveness (acceptor) dopant A halogen (Cl_2 , Br_2 , I_2 , ICl , ICl_3 , IBr , IF), Lewis acid (PF_5 , AsF_5 , SbF_5 , BF_3 , BCl_3 , BBr_3 , SO_3), Proton acid (H HF , HCl , HNO_3 , H_2SO_4 , HClO_4 , FSO_3Cl , SO_3H , $\text{CF}_3\text{SO}_3\text{H}$, various organic acids, amino acid, etc.), a transition-metals compound (FeCl_3 , FeOCl , and TiCl_4 , ZrCl_4 , HfCl_4 , NbF_5 , NbCl_5 , TaCl_5 , MoF_5 , MoCl_5 , WF_6 , WCl_6 , UF_6 and LnCl_3 (lanthanoids, such as $\text{Ln}=\text{La}$, and Ce , Pr , Nd , Sm) -- An electrolyte anion (Cl^- , Br^- , I^- , ClO_4^- , PF_6^- , AsF_6^- , SbF_6^- , BF_4^- , various sulfonic-acid anions), In addition to this ($\text{SbCl}(\text{NO}_2^+)_6^-$) ($\text{BF}(\text{NO}_2^+)_4^-$) (O_2 , XeOF_4 ($\text{SbF}(\text{NO}_2^+)_6^-$), $\text{FSO}_2\text{O}_2\text{SO}_2\text{F}$, AgClO_4 , H_2IrCl_6 , and $\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ grade are mentioned.)

[0045] as the example of an electron-donative (donor) dopant -- alkali metal (Li , Na , K , Rb , Cs), alkaline earth metal (calcium, Sr , Ba), and lanthanoids (Eu etc.) -- in addition -- (R_4N^+ , R_4P^+ , R_4As^+ , R_3S^+ , acetylcholine) etc. -- it is mentioned.

[0046] As a combination of a dopant and said conjugation polymeric materials For example, polyacetylene, Pori (p-phenylene), such as I_2 , AsF_5 , and FeCl_3 , AsF_5 , K , AsF_6^- , etc., The poly thiophene and ClO_4^- , such as polypyrrole and ClO_4^- , polystyrene sulfonate, PORIISO thianaphthenes, such as a nitroso NIUMU salt, an aminium salt, and quinones, I_2 , etc., Pori (p-phenylene sulfide), AsF_5 and Pori (p-phenylene oxide), AsF_5 and the poly aniline, HCl , etc., Pori (p-phenylenevinylene), poly thio phenylenevinylene, such as H_2SO_4 , nickel phthalocyanines, such as I_2 , and **, such as I_2 , are mentioned.

[0047] Moreover, a conductive polymer may be an ion conductive polymer which doped the electrolyte to the macromolecule chain, as an example of a macromolecule chain, polyethers (polyethylene oxide, polypropylene oxide, etc.), polyester (polyethylene succinate, Polly beta propiolactone, etc.), polyamine (polyethyleneimine etc.), polysulfides (polyalkylene sulfide etc.), etc. are mentioned, and various alkali-metal salts etc. are mentioned as a doped electrolyte.

12/24 18-1

[0048] As alkali-metal ion which constitutes said alkali-metal salt, F^- , Cl^- , I^- , NO_3^- , SCN^- , ClO_4^- , $CF_3SO_3^-$, BF_4^- , AsF_6^- , BPh_4^- , etc. are mentioned as an anion in which Li^+ , Na^+ , K^+ , Rb^+ , Cs^+ , etc. form an opposite salt.

[0049] as the combination of a giant-molecule chain and an alkali-metal salt — polyethylene oxide and $LiCF_3$ — polyethylene succinate, such as SO_3 and $LiClO_4$, $LiClO_4$, $LiBF_4$ and Polly beta propiolactone, polyethyleneimine, such as $LiClO_4$, and $NaCF_3$ — polyalkylene sulfides, such as SO_3 and $LiBF_4$, $AgNO_3$, etc. are mentioned. [for example,]

[0050] As for an adjacent layer, in the organic electroluminescence devices of this invention, it is desirable that a film is produced by spreading from a viewpoint of the improvement in endurance of a light emitting device. Moreover, the film production by spreading also from a viewpoint of the simple nature of component production that spreading is possible for a large area at once is desirable. For this reason, the conductive polymer contained in an adjacent layer has especially the desirable thing that can be applied by the organic solvent.

[0051] Next, the ingredient which forms a luminous layer is explained. Oneself contributes the luminescent material contained for the component of this invention to luminescence of a light emitting device, and at least one sort is a triplet luminescent material which emits light from a triplet excitation state. As a triplet luminescent material, what emits light from a triplet excitation state in ordinary temperature is desirable, and transition metal complexes which have an aromatic series ring thru/or aromatic series heterocycle as a ligand more preferably, such as an aromatic series ring thru/or aromatic series heterocycle, etc. containing a heavy atom, are mentioned.

[0052] Although not limited especially as a transition-metals atom which constitutes a transition metal complex, it is a ruthenium, a rhodium, palladium, a tungsten, a rhenium, iridium, and platinum, and they are a ruthenium, a rhenium, iridium, and platinum more preferably. As a ligand of a transition metal complex, for example, work, such as G.Wilkinson, "Comprehensive Coordination Chemistry" Pergamon Press It will publish in 1987. H.Yersin work "Photochemistry and Photophysics of Coordination Compounds" Springer-Verlag It will publish in 1987. Akio Yamamoto work "an organic metal chemistry-foundation and application —" Shokabo Publishing Co., Ltd. 1982 issue The ligand of a publication is mentioned. etc. — preferably a halogen ligand (preferably chlorine ligand) and a nitrogen-containing heterocycle ligand (for example, a phenyl pyridine —) They are diketone ligands (for example, acetylacetone etc.), such as benzoquinoline, quinolinol, a bipyridyl, and a phenanthroline, carboxylic-acid ligands (for example, acetic-acid ligand etc.), a carbon monoxide ligand, an isonitrile ligand, and a cyano ligand.

[0053] As a transition metal complex, an alt.metal-ized metal complex is desirable. an alt.metal-ized metal complex — for example, "an organic metal chemistry-foundation and application" — p150 and 232 Shokabo Publishing Co., Ltd. Akio Yamamoto work The 1982 issue and "Photochemistry and Photophysics of Coordination Compounds" p71-77 and p135-146 Springer-Verlag H.Yersin work 1987 issue etc. — it is the generic name of the compound group indicated. It is the light emitting device ingredient which consists of an alt.metal-ized iridium complex (orthometalated Ir Complexes) preferably especially.

[0054] Trivalent is desirable although especially the valence of the iridium of an alt.metal-ized iridium complex is not limited. The ligand of an alt.metal-ized iridium complex is an aryl group permutation nitrogen-containing heterocycle derivative (the permutation location of an aryl group is on the contiguity carbon of a nitrogen-containing heterocycle nitrogen atom, and as an aryl group, a phenyl group, a naphthyl group, an anthryl radical, a phenan tolyl group, a pyrenyl radical, etc. are mentioned, and it may form a ring, heterocycle, and a condensed ring further.), for example, although it will not ask especially if an alt.metal-ized complex can be formed. As nitrogen-containing heterocycle, it is the hetero aryl group permutation nitrogen-containing heterocycle derivative (the permutation location of a hetero aryl group is on the contiguity carbon of a nitrogen-containing heterocycle nitrogen atom.) with which a pyridine, a pyrimidine, pyrazine, pyridazine, a quinoline, an isoquinoline, quinoxaline, phthalazine, quinazoline, a NAFUCHI lysine, cinnoline, peri MIJIN, a phenanthroline, a pyrrole, an imidazole, a pyrazole, oxazole, OKISA diazole, triazole, thiadiazole, benzimidazole benzoxazole, a bends thiazole, phenanthridine, etc. mentioned, for example 7, 8-benzoquinoline and phosphino aryl with which the radical which

contains the aforementioned nitrogen-containing heterocycle derivative and hetero aryl group, for example, a thienyl group, a furil radical, etc. are mentioned, phosphino hetero aryl, a phosphino KISHIA reel, phosphino KISHIHETEROARIRU, aminomethyl aryl, aminomethyl hetero aryls, these derivatives, etc. are mentioned. Preferably Aryl group permutation nitrogen-containing aromatic series heterocycle, hetero aryl group permutation nitrogen-containing aromatic series heterocycle, They are 7 and 8-benzoquinolines and these derivatives. A phenyl pyridine, A thienyl pyridine, 7, 8-benzoquinoline, a benzyl pyridine, a phenyl pyrazole, The phenyl substitution products and these derivatives of the azole which has a phenyl isoquinoline and two nitrogen atoms or more are still more desirable, and the aromatic series heterocycle which the aryl group with an electronic suction nature machine (for example, a halogen atom, a cyano group, an azole radical) permuted, and especially its derivative are desirable.

[0055] The above-mentioned thing is included. As an example of triplet luminescent material For example, JP,2001-181616,A, Provisional publication of a patent No. 181617 [2001 to], provisional publication of a patent No. 247859 [2001 to], an application for patent No. 89274 [2000 to], JP,2002-203679,A, JP,2002-241751,A, JP,2002-117978,A, JP,2002-170684,A, an application for patent No. 239281 [2001 to], an application for patent No. 248165 [2001 to], A compound WO 00/No. 57676, WO 00/No. 70655, WO01 / No. 39234A2, WO01 / No. 41512A1, and given in US6097147 No. A etc. is mentioned.

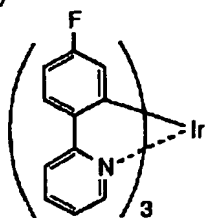
[0056] Although it is not limited, when the application to a full color display etc. is taken into consideration, as for especially the emission spectrum of the organic electroluminescence devices of this invention, it is desirable that it is 500nm or less (blue luminescence) about luminescence maximum wave length. As a luminescent material, it is desirable that the minimum excitation triplet energy level (T1 level) is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 55 kcal/mol (230 kJ/mol), and in order to consider as a blue light emitting device, it is desirable that it is especially below 81 kcal/mol (340 kJ/mol) more than 63 kcal/mol (264 kJ/mol). Furthermore, in order to raise the luminous efficiency of a component, the quantum yield of the phosphorescence of luminescent material is 0.5 (0.7 or more [0.6 or more / Preferably / especially preferably]) or more preferably.

[0057] The following examples are given as a desirable luminescent material in this invention.

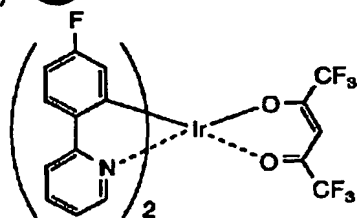
[0058]

[Formula 13]

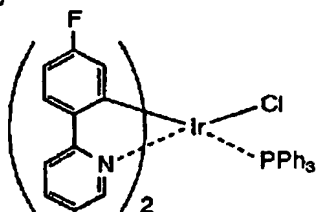
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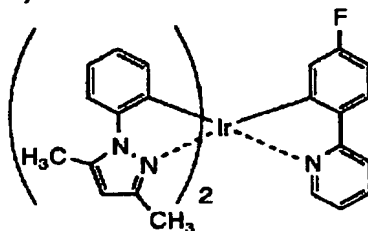
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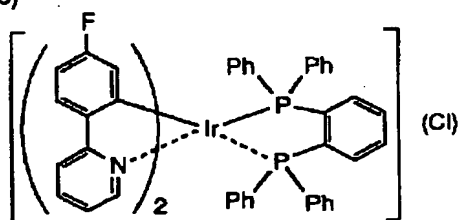
(D-3)



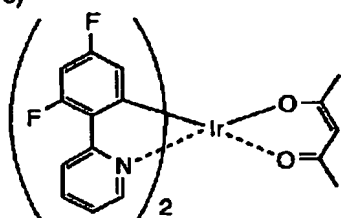
(D-4)



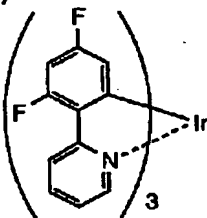
(D-5)



(D-6)

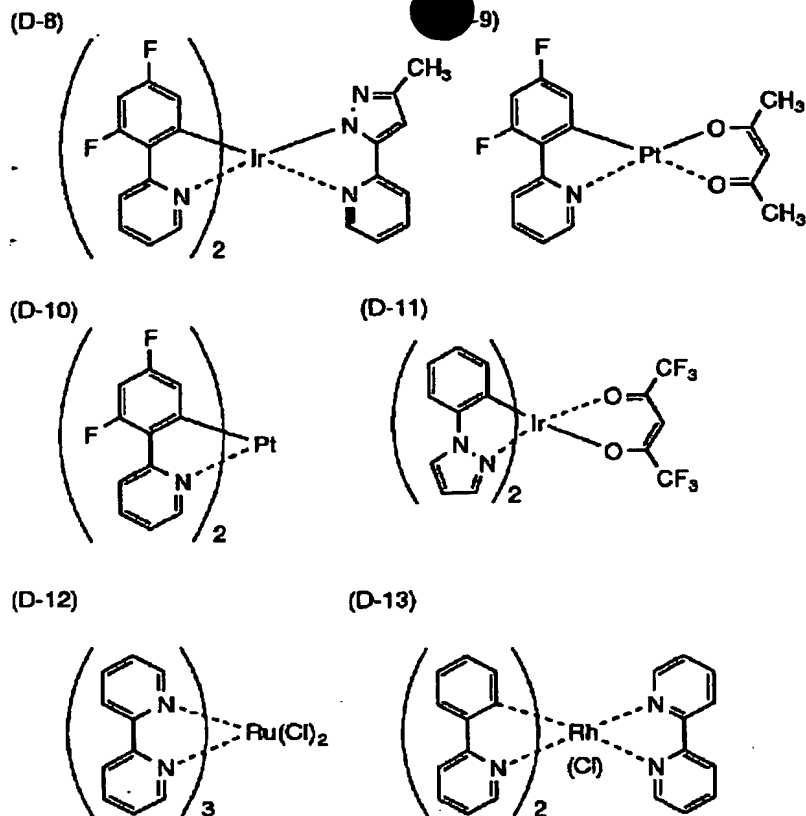


(D-7)



[0059]

[Formula 14]



[0060] Next, a host ingredient is explained. A host ingredient is what forms a luminous layer with luminescent material. At the time of electric-field impression An anode plate or a hole-injection layer, It has the function to pour an electron hole into a luminous layer from an electron hole transportation layer, and to pour an electron into a luminous layer from cathode or an electron injection layer, and an electronic transportation layer. You move the charge furthermore poured in within a luminous layer, an electron hole and an electron make it recombine, and it has the function to hand over the generated exciton of an electron and an electron hole pair to luminescent material, and to make luminescent material emit light. It will not be limited especially if it has the above-mentioned function as a host ingredient. As a compound used for the organic electroluminescence devices of this invention as a host ingredient For example, a carbazole, Indore, a pyrrole, a pyrazole, an imidazole, A benzimidazole pyrazolo pyridine, an imidazolo pyridine, imidazolo pyrazine, A nitrogen-containing heterocycle compound like benzimidazole benzo oxazole, benzimidazole, and benzothiazole, A ** sulfur heterocycle compound like a thiophene and a bends thiophene, styryl benzene, polyphenyl, a diphenyl butadiene, a fluorene, and an aromatic series condensed ring carbocyclic compound (naphthalene —) Tetra-phenyl butadienes, such as an anthracene and a pyrene, North America Free Trade Agreement RUIMIDO, Coumarin, perylene, and peri non, OKISA diazole, aldazine, PIRARIJIN, A cyclopentadiene, a bis-styryl anthracene, Quinacridone, a pyrrolo pyridine, A thiadiazolo pyridine, a styryl amine, an aromatic dimethylidyne compound, The metal complex of an aniline derivative like a thoria reel amine compound and a dialkyl aniline compound and an eight-quinolinol derivative, various metal complexes, the above-mentioned derivative which are represented by an organometallic complex and the rare earth complex, etc. are mentioned.

[0061] The host ingredient itself may emit light by the generated exciton. In that case, although a permissible luminescence region changes by the luminescence region of the request from the whole component, what has luminescence in a green region from ultraviolet as host ingredient independent film is usually desirable. As such a host ingredient, nitrogen-containing heterocycles, such as a carbazole, Indore, a pyrrole, a benzimidazole pudding, a benzimidazole pyrazolo pyridine, an imidazolo pyridine, and imidazolo pyrazine, a 2 permutation aniline compound, a thiophene compound, polyphenyls and these derivatives, or an organometallic

complex is mentioned preferably. An ingredient given in JP,2002-100476, is mentioned still more preferably as a host ingredient. Moreover, in this invention, as described above, the luminous layer which consists of a host ingredient and luminescent material adjoins the layer containing a conductive polymer.

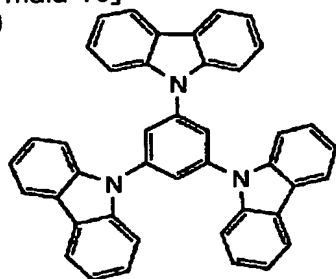
[0062] What has the larger excitation triplet energy level (T1 level) of the ingredient (host ingredient) except luminescent material than T1 level of luminescent material is desired among the ingredients which form a luminous layer. By making T1 level of a host ingredient larger than T1 level of luminescent material, the exciton generated with the host ingredient moves to luminescent material, the probability to cause luminescence becomes high, and luminous efficiency improves. Therefore, as a luminous layer except luminescent material, as for T1 level, it is desirable that it is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 55 kcal/mol (230 kJ/mol). Especially in the case of a blue light emitting device, it is below 82 kcal/mol (344 kJ/mol) (it is 67kcal (280 kJ/mol)/mol especially preferably 65 kcal/mol (272 kJ/mol) more preferably as a lower limit) more than more than 64 kcal/mol (268 kJ/mol) preferably.

[0063] The following examples are given as a desirable host ingredient in this invention.

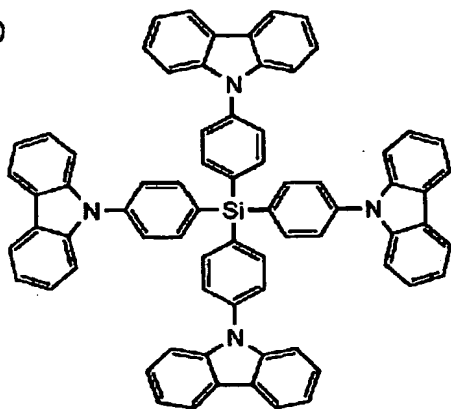
[0064]

[Formula 15]

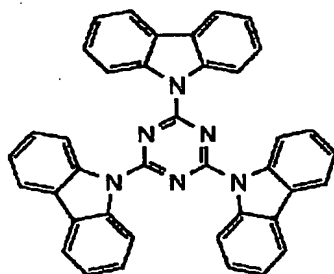
(H-1)



(H-2)

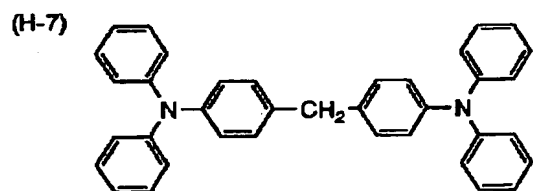
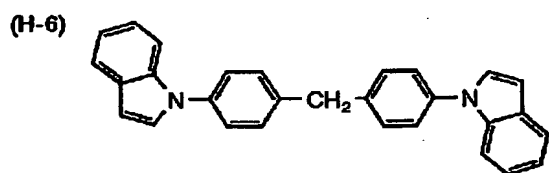
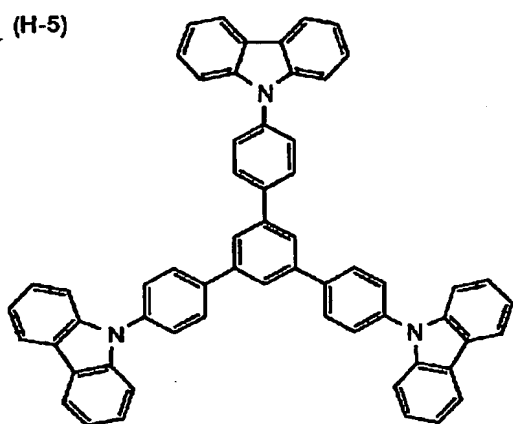
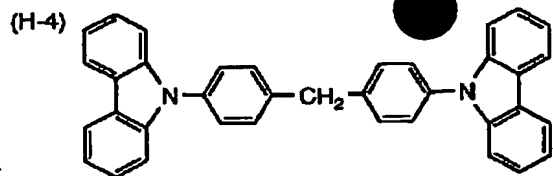


(H-3)



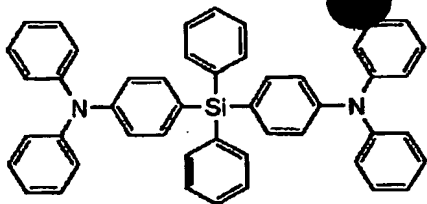
[0065]

[Formula 16]

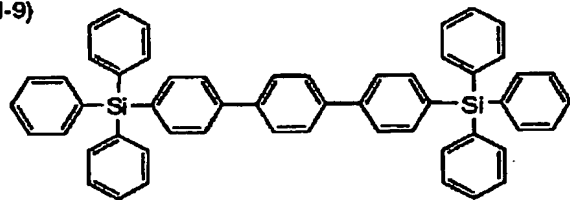


[0066]
[Formula 17]

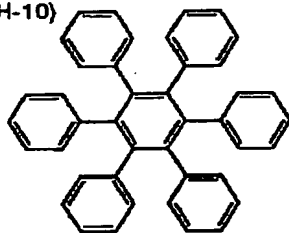
(H-8)



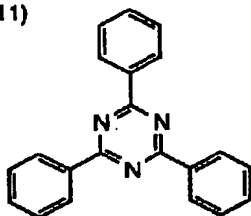
(H-9)



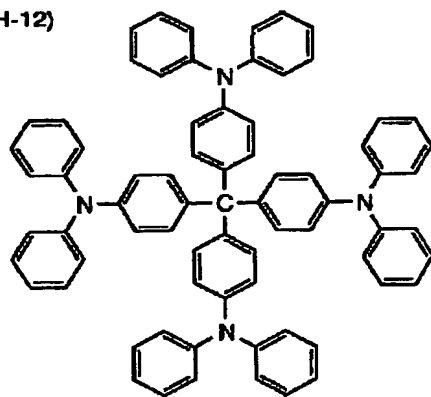
(H-10)



(H-11)



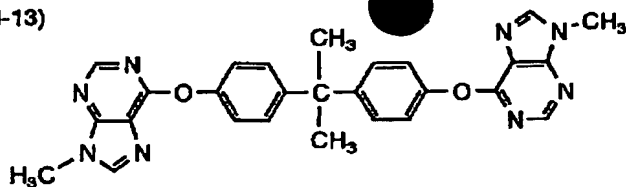
(H-12)



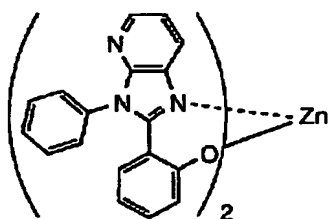
[0067]

[Formula 18]

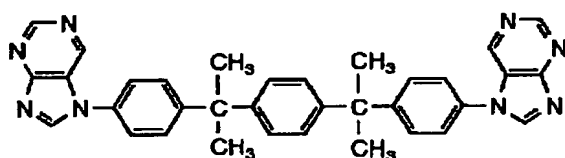
(H-13)



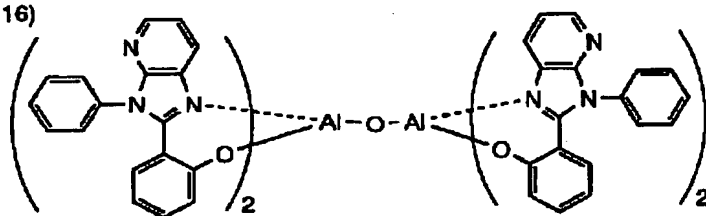
-(H-14)



(H-15)



(H-16)



[0068] The luminous layer of the organic electroluminescence devices of this invention is produced by vacuum deposition. By producing a film with vacuum deposition, efficient luminescence is possible compared with the applying method etc. Resistance heating vacuum deposition etc. is mentioned as vacuum deposition.

[0069] Although a luminous layer consists of an above-mentioned luminescent material and an above-mentioned host ingredient, it may contain the electronic transportation ingredient illustrated in the further below-mentioned electronic transportation layer. Although especially the thickness of a luminous layer is not limited, usually the thing of the range of 1nm - 5 micrometers is desirable, and is 5nm - 1 micrometer more preferably, and it is 10nm - 500nm still more preferably.

[0070] Next, layers other than the adjacent layer containing a conductive polymer in the organic electroluminescence devices of this invention and a luminous layer are explained. An anode plate can supply an electron hole to a hole-injection layer, an electron hole transportation layer, a luminous layer, etc., a metal, an alloy, a metallic oxide, electrical conductivity compounds, or such mixture can be used, and a work function is an ingredient 4eV or more preferably. As an example, conductive metallic oxide, such as tin oxide, a zinc oxide, indium oxide, and indium tin oxide (ITO), To metals, such as gold, silver, chromium, and nickel, and a pan, or the mixture of these metals and conductive metallic oxide, Or inorganic conductivity matter, such as laminated material, copper iodide, and copper sulfide, the poly aniline, Organic conductivity ingredients, such as the poly thiophene and polypyrrole, the laminated material of these and ITO, etc. are mentioned, preferably, it is conductive metallic oxide and ITO is desirable from viewpoints, such as productivity, high conductivity, and transparency, especially. Although the thickness of an anode plate is selectable suitably by the ingredient, usually the thing of the range of 10nm - 5 micrometers is desirable, and is 50nm - 1 micrometer more preferably, and it is 100nm - 500nm still more preferably.

[0071] What usually carried out the stratification of the anode plate on this substrate, using soda lime glass, alkali free glass, and transparency resin as a substrate is used. As a substrate, when

using glass, in order to lessen the elution ion from glass, about the quality of the material, it is desirable to use alkali free glass. Moreover, when using soda lime glass, it is desirable to use what gave barrier coating sealant, such as a silica. If the thickness of a substrate is sufficient thickness to maintain a mechanical strength, there will be especially no limit, but in using glass, it usually uses a thing 0.7mm or more preferably 0.2mm or more.

[0072] Although various approaches are used for production of an anode plate with an ingredient, in ITO, film formation is carried out by approaches, such as spreading of an electron beam method, the sputtering method, resistance heating vacuum deposition, chemical reaction methods (sol-gel method etc.), and the distributed object of ITO, for example. By processing of washing and others, the driver voltage of a component is lowered or an anode plate can also raise luminous efficiency. For example, in ITO, UV-ozonization, plasma treatment, etc. are effective.

[0073] Cathode supplies an electron to an electron injection layer, an electronic transportation layer, a luminous layer, etc., and is chosen in consideration of adhesion with the layer which adjoins cathode, such as an electron injection layer, an electronic transportation layer, and a luminous layer, ionization potential, stability, etc. As an ingredient of cathode, a metal, an alloy, a metallic oxide, electrical conductivity compounds, or such mixture can be used. As an example, alkali metal (for example, Li, Na, K, Cs, etc.) or the fluoride of those, The oxide, alkaline earth metal (for example, Mg, calcium, etc.), or the fluoride of those, The oxide, gold, silver, lead, aluminum, a sodium-potassium alloy, Or those mixed metals, lithium-aluminium alloys, or those mixed metals, Rare earth metals, such as magnesium-silver alloys or those mixed metals, an indium, and an ytterbium, are mentioned. A work function is an ingredient 4eV or less preferably, and they are aluminum, lithium-aluminium alloys or those mixed metals, magnesium-silver alloys, or those mixed metals more preferably. Although the thickness of cathode is selectable suitably by the ingredient, usually the thing of the range of 10nm - 5 micrometers is desirable, and is 50nm - 1 micrometer more preferably, and it is 100nm - 1 micrometer still more preferably.

[0074] Approaches, such as an electron beam method, the sputtering method, resistance heating vacuum deposition, and a coating method, are used for production of cathode, and vapor-depositing a metal alone can also vapor-deposit two or more components to coincidence. Furthermore, the alloy which is possible also for vapor-depositing two or more metals to coincidence, and forming an alloy electrode, and was adjusted beforehand may be made to vapor-deposit. The lower one of the sheet resistance of an anode plate and cathode is desirable, and below its hundreds of ohms / ** are desirable.

[0075] The ingredient of a hole-injection layer and an electron hole transportation layer should just have the function to pour in an electron hole from an anode plate, the function to convey an electron hole, or the function that carries out the obstruction of the electron poured in from cathode. As the example, a carbazole, an imidazole, triazole, Oxazole, OKISA diazole, the poly aryl alkane, pyrazoline, A pyrazolone, a phenylenediamine, arylamine, an amino permutation chalcone, a styryl anthracene and full -- me -- non, a hydrazone, a stilbene, and a silazane -- An aromatic series tertiary-amine compound, a styryl amine, an aromatic dimethyldiyne compound, Conductive polymer oligomer, such as a porphyrin system compound, a polysilane system compound, Pori (N-vinylcarbazole), an aniline system copolymer, thiophene oligomer and a polymer, and the poly thiophene, and a polymer, the carbon film, the above-mentioned derivative, etc. are mentioned. Although especially the thickness of a hole-injection layer and an electron hole transportation layer is not limited by the quality of the material, usually the thing of the range of 1nm - 5 micrometers is desirable, and is 5nm - 1 micrometer more preferably, and it is 10nm - 500nm still more preferably. A hole-injection layer and an electron hole transportation layer may be monolayer structures which consist of one sort of the ingredient mentioned above, or two sorts or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0076] as the formation approach of a hole-injection layer and an electron hole transportation layer -- vacuum evaporation technique and LB -- the approaches (a spin coat method, the cast method, dip coating method, etc.) of dissolving or distributing a solvent and coating it with law, the ink jet method, print processes, a replica method, a xerography, said hole-injection

ingredient, and an electron hole transportation ingredient are used. In the case of a coating method, it can dissolve or distribute with a resinous principle, and a polyvinyl chloride, a polycarbonate, polystyrene, polymethylmethacrylate, polyester, polysulfone, polyphenylene oxide, polybutadiene, Pori (N-vinylcarbazole), hydrocarbon resin, ketone resin, phenoxy resin, a polyamide, ethyl cellulose, vinyl acetate, ABS plastics, polyurethane, melamine resin, an unsaturated polyester resin, alkyd resin, an epoxy resin, silicon resin, etc. are mentioned as a resinous principle.

[0077] The ingredient of an electron injection layer and an electronic transportation layer should just have the function to pour in an electron from cathode, the function to convey an electron, or the function that carries out the obstruction of the electron hole which might be poured in from the anode plate. the heterocycle frame which contains two or more hetero atoms as the example, OKISA diazole, and full -- me -- non, various metal complexes, the above-mentioned derivative, etc. which are represented by the metal complex which makes a ligand ring tetracarboxylic acid anhydrides, such as anthra quinodimethan, an anthrone, a diphenyl quinone, thiopyran dioxide, a carbodiimide, full ORENIRIDEN methane, JISUCHIRIRU pyrazine, and naphthalene perylene, a phthalocyanine, the metal complex of an eight-quinolinol derivative and a metal phthalocyanine, benzo oxazole, and benzothiazole are mentioned. It may be the compound which has atoms other than a carbon atom and a hydrogen atom in [two or more] a basic frame as a heterocycle frame containing two or more hetero atoms as a heterocycle compound containing at least two or more hetero atoms, and you may be a monocycle or a condensed ring. It is the aromatic series heterocycle which has two or more atoms preferably chosen from N, O, and S atom as a heterocycle frame, and has an at least 1N atom in a frame still more preferably, and is the aromatic series heterocycle which has N atom in [two or more] a frame preferably especially. Moreover, a hetero atom may be in a condensation location, or may be in a non-condensation location. For example, a pyrazole, an imidazole, oxazole, a thiazole, triazole, OKISA diazole, thiadiazole, pyrazine, a pyrimidine, indazole, A pudding, phthalazine, a NAFUCHI lysine, quinoxaline, quinazoline, cinnoline, A pteridine, peri MIJIN, a phenanthroline, a pyrrolo imidazole, Pyrrolo triazole, a pyrazolo imidazole, pyrazolo triazole, A pyrazolo pyrimidine, pyrazolo triazine, an imidazo imidazole, Imidazo pyridazine, an imidazo pyridine, imidazo pyrazine, a triazolo pyridine, Benzimidazole, a naphth imidazole, benzo oxazole, naphth oxazole, benzothiazole, a naphth thiazole, benzotriazol, a TETORAZA indene, triazine, etc. are mentioned. Especially, it is triazole, OKISA diazole, thiadiazole, imidazo pyridazine, an imidazo pyridine, imidazo pyrazine, benzimidazole, a naphth imidazole, benzo oxazole, naphth oxazole, benzothiazole, a naphth thiazole, and triazine preferably, and is an imidazo pyridine, imidazo pyrazine, benzimidazole, and a naphth imidazole more preferably, and they are an imidazo pyridine, benzimidazole, a naphth imidazole, and triazine still more preferably.

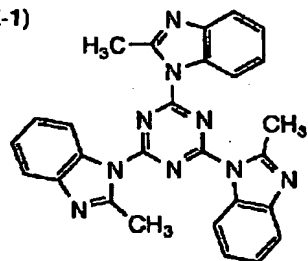
[0078] It is desirable from the point of luminous efficiency to consist of a compound which has T1 level higher than the ingredient which forms a luminous layer preferably especially as an electron injection layer and an electronic transportation layer. Therefore, as for T1 level of the electronic transportation ingredient independent film, it is desirable that it is below 90 kcal/mol (378 kJ/mol) more than 45 kcal/mol (188 kJ/mol), and it is more desirable that it is below 85 kcal/mol (356 kJ/mol) more than 58 kcal/mol (243 kJ/mol). Especially in the case of a blue light emitting device, it is desirable that it is below 82 kcal/mol (344 kJ/mol) more than 64 kcal/mol (268 kJ/mol).

[0079] The following examples are given as a desirable electronic transportation ingredient in this invention.

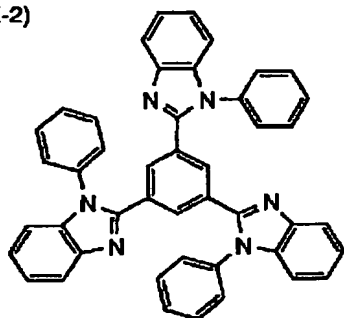
[0080]

[Formula 19]

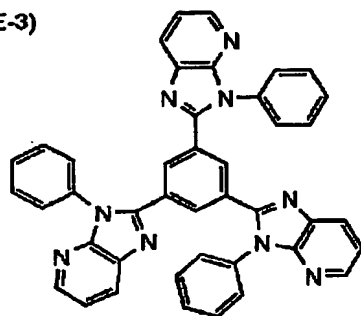
(E-1)



(E-2)



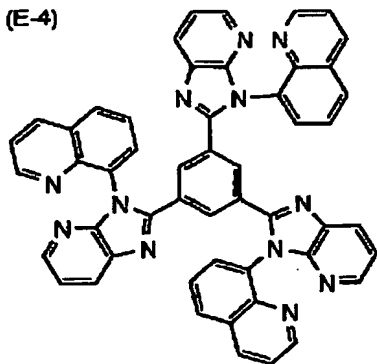
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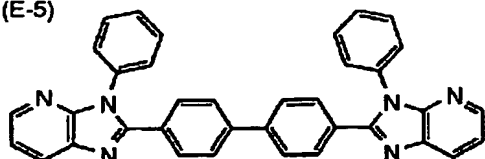
[0081]

[Formula 20]

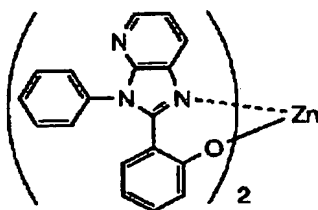
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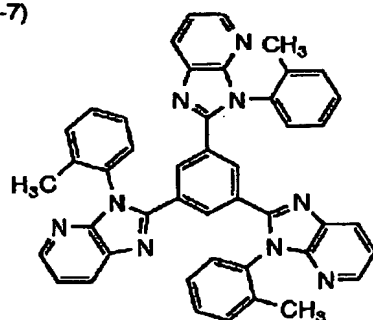
(E-5)



(E-6)



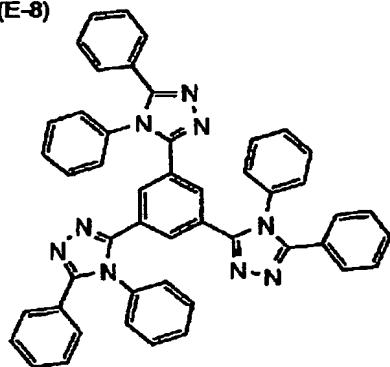
(E-7)



[0082]

[Formula 21]

(E-8)



[0083] Although especially the thickness of an electron injection layer and an electronic transportation layer is not limited, usually the thing of the range of 1nm – 5 micrometers is desirable, and is 5nm – 1 micrometer more preferably, and it is 10nm – 500nm still more preferably. An electron injection layer and an electronic transportation layer may be monolayer

structures which consist of one sort of the ingredient mentioned above, two sorts or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation. as the formation approach of an electron injection layer and an electronic transportation layer -- vacuum evaporation technique and LB -- the approaches (a spin coat method, the cast method, dip coating method, etc.) of dissolving or distributing a solvent and coating it with law, the ink jet method, print processes, a replica method, a xerography, said electron injection ingredient, and an electronic transportation ingredient are used. In the case of a coating method, it can dissolve or distribute with a resinous principle, and what was illustrated as a resinous principle in the case of for example, the hole injection and the transportation layer can be applied.

[0084] In the light emitting device of this invention, a protective layer may be prepared in the maximum front face. What is necessary is just to have the function which inhibits that what promotes component degradation of moisture, oxygen, etc. as an ingredient of a protective layer enters in a component. As the example, In, Sn, Pb, Au, Cu, Ag, aluminum, Metals, such as Ti and nickel, MgO, SiO and SiO₂, aluminum₂O₃, GeO, Metallic oxides, such as NiO, CaO, BaO, Fe₂O₃, Y₂O₃, and TiO₂, Metal fluorides, such as nitrides, such as SiN_x and SiN_xO_y, and MgF₂, LiF, AlF₃, CaF₂, Polyethylene, polypropylene, polymethylmethacrylate, polyimide, Poly urea, polytetrafluoroethylene, polychlorotrifluoroethylene resin, The copolymer of poly dichlorodifluoroethene, chlorotrifluoroethylene, and dichlorodifluoroethene, The copolymer which is made to carry out copolymerization of the monomer mixture containing at least one sort of comonomers to tetrafluoroethylene, and is obtained, the fluorine-containing copolymer which has cyclic structure in a copolymerization principal chain, the absorptivity matter of 1% or more of water absorption, the dampproof matter of 0.1% or less of water absorption, etc. are mentioned.

[0085] the formation approach of a protective layer -- especially -- limitation -- there is nothing -- for example, a vacuum deposition method, the sputtering method, a reactive sputtering method, and MBE (molecular beam epitaxy) -- law, the ionized cluster beam method, the ion plating method, a plasma polymerization method (the high-frequency excitation ion plating method), a plasma-CVD method, a laser CVD method, a heat CVD method, a gas source CVD method, a coating method, the ink jet method, print processes, a replica method, and a xerography are applicable.

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1/4 8-2

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EXAMPLE

[Example] Although an example is given to below and this invention is concretely explained to it, thereby, this invention is not limited.

What produced ITO by the thickness of 150nm on the example 125mmx25mmx0.7mm glass substrate (Tokyo Sanyo Vacuum Co., Ltd. make) was used as the transparence support substrate. The spin coat was carried out on the substrate which washed BaytronP (a PEDOT-PSS water distribution object (polyethylene dioxythiophene-polystyrene sulfonate dope object) / Bayer make) as a conductive ingredient which forms an adjacent layer for this transparence support substrate after etching and washing (1000rpm, 30 seconds), and the vacuum drying was carried out at 150 degrees C for 1.5 hours. The thickness of an adjacent layer was 50nm. This substrate was put into vacuum evaporatio equipment, vapor codeposition was carried out so that thickness might serve as an evaporation rate of 0.04nm/second in the vacuum of 10⁻³ to ten to 4 Pa and might be served as [ingredient / (H-1) / luminescent material (D-1) and / host] to 36nm in 0.4nm/[in a second] next under the condition of a substrate temperature room temperature, respectively, and the luminous layer was formed. After having vapor-deposited 36nm (E-1) of electronic transportation ingredients furthermore, equipping with the mask (luminescence area is set to 4mmx5mm) which carried out patterning on the organic thin film and vapor-depositing 5nm of lithium fluoride, 50nm was vapor-deposited for aluminum, the component was closed succeedingly, and the EL element was produced (component No.101).

[0087] Baytron of example 2 example 1 The substrate which carried out the spin coat of TPDPEs-TBPA which is similarly a conductive ingredient instead of P was put into vacuum evaporatio equipment, and the same component as an example 1 was produced (component No.102).

[0088] 10nm was vapor-deposited instead of the electronic transportation ingredient (E-1) of example 3 example 2, Alq3 [30nm] was vapor-deposited for BCP on it, lithium fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.103).

[0089] Ir(ppy) 3 was used instead of the luminescent material (D-1) of example 4 example 3, and the component using CBP as a host ingredient was produced (component No.104).

[0090] The substrate which carried out the spin coat of TPDPEs-TBPA like example of comparison 1 example 2 was put into vacuum evaporatio equipment, and 50nm of NPD(s) was vapor-deposited under the condition of a substrate temperature room temperature in the vacuum of 10⁻³ to ten to 4 Pa. Next, vapor codeposition of luminescent material Ir(ppy) 3 and the host ingredient (CBP) was carried out so that thickness might be set to 36nm in a second in the evaporation rate of 0.04nm/second, and 0.4nm /, respectively, and the luminous layer was formed. Furthermore, Alq3 [30nm] was vapor-deposited for BCP 10nm and on it, lithium fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.105).

[0091] The luminescent material of the example 1 of example of comparison 2 comparison was changed into (D-1), and the same component was produced (component No.106).

[0092] The host ingredient of the example 2 of example of comparison 3 comparison was changed into (H-1), and the same component was produced (component No.107).

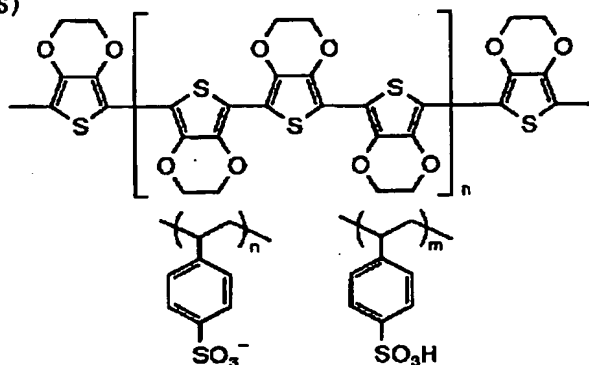
[0093] The spin coat of what dissolved Pori (N-vinylcarbazole) 40mg and (ppy)34mg in dichloroethane 2.5ml was carried out on the substrate which carried out the spin coat of PEDOT-PSS like example of comparison 4 example 1. The total thickness of an organic layer was 80nm. This substrate was put into vacuum evaporation equipment, in the vacuum of 10^{-3} to ten to 4 Pa, 30nm and 20nm of Alq(s) were vapor-deposited for TAZ next under the condition of a substrate temperature room temperature, lithium fluoride and aluminum were vapor-deposited by the same approach as an example 1, the component was closed succeedingly, and the EL element was produced (component No.108).

[0094] The structure of the compound used for below by this invention is shown.

[0095]

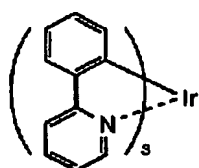
[Formula 22]

(PEDOT-PSS)

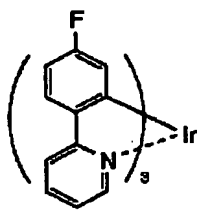


(Ir(ppy))₃

(D-1)

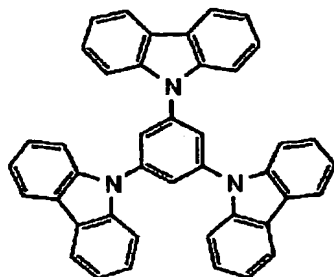


T₁レベル
60kcal/mol
(252kJ/mol)
燐光の量子収率
 $\phi_{ph}=0.70$



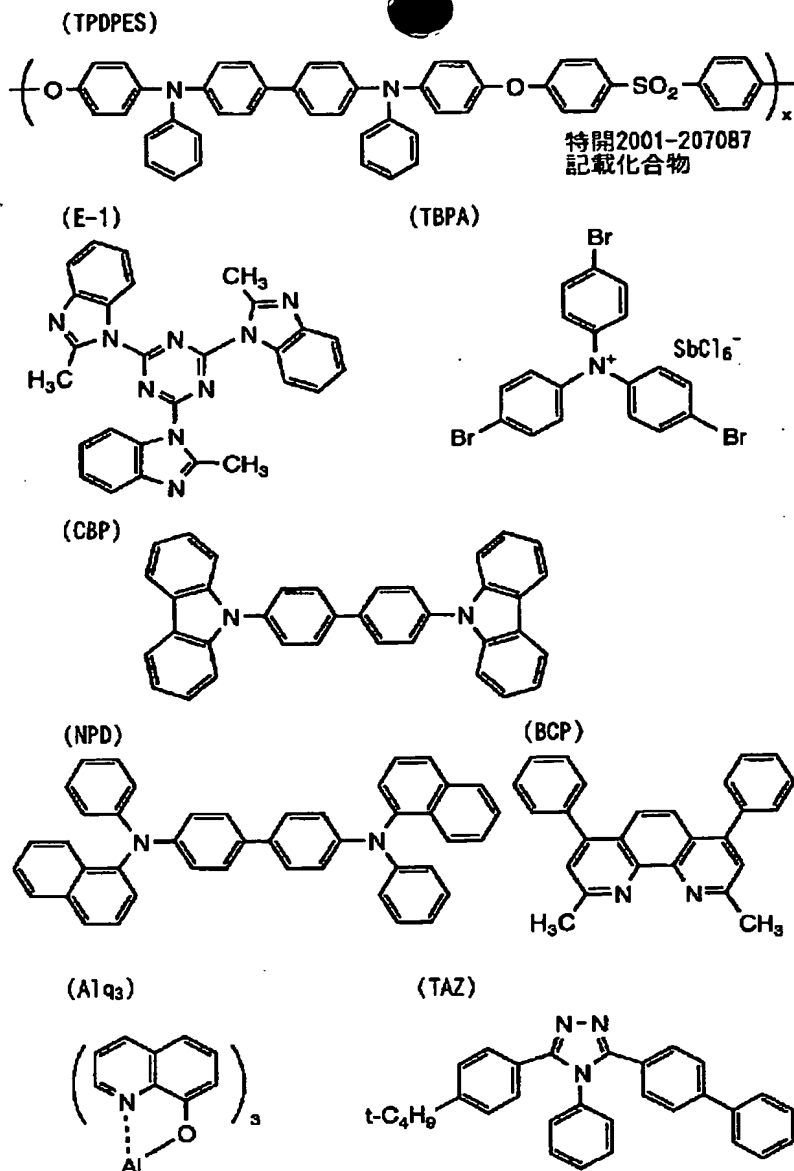
T₁レベル
63kcal/mol
(264kJ/mol)
燐光の量子収率
 $\phi_{ph}=0.91$

(H-1)



[0096]

[Formula 23]



[0097] Next, each component which is the following, and was made and produced was evaluated. An evaluation result is shown in Table 1. direct-current constant current is impressed to an organic thin film by using aluminum as cathode using the TOYO source major unit 2400, using ITO as an anode plate, and light is emitted in the component of the example of a comparison, and this invention -- making -- the brightness -- luminance-meter BM-8 of TOPCON CORP., and luminescence wavelength -- the Hamamatsu Photonics make -- it measured using spectrum analyzer PMA-11 and luminous efficiency was searched for. Moreover, the constant current drive of the component was carried out by initial brightness 100 cd/m², and brightness half line was measured. Moreover, when the minimum excitation triplet energy level of the film of the luminous layer excluding luminescent material from the luminous layer was measured, CBP was 62 kcal/mol (260 kJ/mol) and H-1 was 65 kcal/mol (272 kJ/mol).

[0098]

[Table 1]

素子 No.	ELmax	色度(x,y)	量子効率	駆動電圧 (5000cd/m ²)	備考
101	488nm	(0.15,0.52)	22%	10.0V	本発明
102	486nm	(0.17,0.49)	20%	10.2V	本発明
103	484nm	(0.16,0.52)	15%	10.5V	本発明
104	517nm	(0.31,0.61)	17%	10.4V	本発明
105	516nm	(0.31,0.61)	16%	12.0V	比較例
106	485nm	(0.17,0.49)	4%	15.0V	比較例
107	485nm	(0.17,0.49)	5%	14.1V	比較例
108	514nm	(0.31,0.60)	2%	12.3V	比較例

[0099] Here, a chromaticity shows the value of the chromaticity coordinate (x y) defined by the CIE color system.

[0100] The component which produced the luminous layer by vacuum evaporation compared with the component (component No.108) which produced the luminous layer by spreading so that clearly from the result of Table 1 is excellent in luminous efficiency. And although luminous efficiency fell greatly when the luminescent material of an efficient green light emitting device (component No.105) was changed into the short wave luminescent material (D-1) of blue luminescence (106 component No. 107), by making a conductive ingredient layer adjoin a luminous layer, and using the host ingredient which has the high minimum excitation triplet energy level shows that efficient luminescence can be carried out (component No.101-103). Moreover, if driver voltage in case the luminescence brightness of a component is 5000 cd/m² is compared, this invention component is about about 10v, and a low-battery drive is possible for it compared with a comparison component. When the efficient light emitting device of this invention compares the brightness maintenance factor after excelling also in endurance and performing a constant voltage drive for 30 minutes by initial brightness 5000 cd/m², it is a 107= 11 times as many 101/component of components as this, and a 105= 2 twice as many 104/component of components as this, and the component of this invention is excellent in the endurance at the time of high brightness luminescence. Compared with the example component of a comparison, destruction of a component does not take place under the high voltage and a high current, but high brightness luminescence is still more possible for the component of this invention.

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